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J. M. WAKEMAN, - - - - - - President and General Manager.

CHICAGO OFFICE, - - - - - - - - - - 1139 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - - - - 929 Chestnut Street.

EUROPEAN OFFICE, - - - - - - - - - - A. C. Shaw, Manager.
Hastings House, Norfolk St., Strand, London, England.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - - - Associate Editor.

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TELEPHONY IN EUROPE.

The review made by Mr. U. N. Bethell in this issue of the conditions of telephony in Europe is a most interesting and valuable contribution to the literature of the art, and the discussions thereto pertaining. While it is only an abstract or excerpt of evidence given before the United States Industrial Commission, it serves to show that the commission made no mistake in asking Mr. Bethell to appear before them. The comment of a trained expert and shrewd observer on his art as he finds it practised in other countries than his own, is always highly useful, and we are confident that Mr. Bethell's views and facts will be noted with keen interest here and abroad. Many will not agree with him, but the intrinsic value of his remarks entitles them to a careful and thoughtful consideration. We may say for ourselves, for example, that we believe that, thanks to the very competition in telephony here, that Mr. Bethell condemns in some parts of Europe, the art is now being developed more rapidly than ever before; but neither he nor we can predict whether such competitive conditions are to endure forever indefinitely. It may be added, however, that if the remarkable figures of "independent" telephone growth are added to those of the Bell system, the undeniable preponderance here, in development, as compared with abroad, is even more astounding. Mr. Bethell gives as a sole reason control by other than private enterprise in the European systems. It would, at any rate, appear evident that the telephonic development of Europe has but barely begun, and should afford a large outlet for capital and production for many years to come, with great benefit not only to electrical industries but to the population of every country mentioned in Mr. Bethell's review of the situation.

THE PAN-AMERICAN EXPOSITION.

The Pan-American Exposition is now at the height of its glory so far as relates to its exhibits, although its attendance may be expected to increase as the season advances and the weather becomes less warm and more genial. It is interesting to compare this exhibition with those which have preceded it. In the first place, the Pan-American Exposition cannot properly be called an International exhibition, because only North and South America are included within the lists of exhibitors. Europe sends no exhibits; in fact, although, as the name Pan-American suggests, all American countries are represented, yet there is relatively little "pan" in the aggregation, and the great bulk of the exhibits is from the United States. Consequently, there is not the same extent or range of exhibits that would be found in a similar exhibition of international co-operation. The buildings are, on the average, decidedly smaller than those which appeared in the Chicago World's Fair. On the other hand, however, the buildings at Buffalo, if not so imposing as those of Chicago, are more beautiful in point of color. The Chicago buildings were all white with the whiteness of whitewash. These buildings have been judiciously tinted in a manner which is both harmonious and in keeping with their architectural style.

At Paris, and more particularly at Chicago, the distances in the exhibition were so considerable that intramural transport by trolley was necessary. At Buffalo the main buildings are sufficiently close to each other to make an intramural railway dispensable, and the visitors make their way either by perambulation or by perambulators. The distribution of the various buildings has been excellent, both from an architectural and from a topographical standpoint. The

only unfortunate disposition lies in regard to the Art Gallery, which is hidden away in a grove at a distance of half a mile from the main buildings. In Europe an Exposition usually devotes a large portion of space to works of art and a subsidiary space to works of machinery. In Buffalo the conditions are reversed. The Art Gallery at Buffalo is, however, particularly interesting as representing the development of American painting, drawing and sculpture, and gives a great treat to all lovers of the æsthetic. The salient feature of the Exhibition is the electric lighting, which excites universal admiration. This is almost wholly carried out by means of incandescent lamps of 8 candle-power, which have been scattered over the buildings and avenues with lavish hand. It has been the custom in previous exhibitions to limn and edge the outlines of the buildings with rows of incandescent lamps. At Buffalo, in addition to this, some of the prominent buildings are faced with large clusters of lamps which cause them to shine resplendent. The absence of arc lamps enhances the effect of uniform lustre.

In regard to the electrical exhibit it may be said to be very complete and satisfactory, doing justice to American manufacture. A prominent feature is the absence of that variety of new types in dynamos which was so marked a few years ago. It would seem that dynamos have settled into definitely marked types of structure as the result of past evolution and development. On the other hand, although the generating apparatus may have become somewhat stereotyped, the apparatus for controlling and directing electrical energy is in course of active development. Thus, high-tension switches, circuit breakers, and similar appliances exist in considerable numbers. Long-distance transmission appliances are developing insulating features that suggest the insulation of high-tension apparatus such as frictional machines, and Ruhmkorff coils. Switches and switch-mechanisms are being constructed in larger sizes and of greater power. The largest are now operated by electric motors, i. e., by electro-mechanical power intermediate between the hand and the main switch. In other words, the largest switches are becoming too heavy to work directly by hand. The contrast between the largest modern switches and those which were in use 15 years ago is very striking.

The fact that power from the Falls of Niagara, transmitted electrically, is used for nearly all the electric lighting and most of the power distribution in the Exposition, gives a special attractiveness Niagara dynamos is just on the limit of giving discomfort to the eye in connection with incandescent lamps. Under some conditions of incandescent lighting a slight unpleasant pulsation or flickering is discernible. Under other conditions it is not noticeable. The consolidation of the lighting supply of the Exposition to three 11,000-volt mains fed through a large triple-bladed switch, readily lends itself to the gradual increase in brightness at turning on the lamps that constitutes so attractive a feature. The Nernst lamp is exhibted at Buffalo for the first time as a working apparatus in useful service, being employed in lighting the interior of the Electrical Building. At no preceding exhibition have steam engines, steam boilers and smokestacks occupied so insignificant a position in comparison with the lighting effect, as at Buffalo. In electric power transmission the Niagara-Buffalo system forms in itself, at the Exposition, a notable display of modern power capabilities in this direction.

Altogether, the Exposition is well worth a long jonrney to visit, if only for the color effects of its buildings by day, and the luminous effects on its buildings by night. It will long be remembered for its attractiveness, beauty and good organization.

The Calcutta Local Section of Electrical Engineering.

In the current number of the *Journal* of the British Institution of Electrical Engineers appears the inaugural address of the chairman of the Calcutta local section. The birth of this new East Indian section appears to have been attended with due local celebration on the 15th of last March. Hindostan has for many years past been proud of a fine Government telegraph system, which has had many local difficulties to contend with. These difficulties have been in transport, in native superstition, in jungles, and in maintaining great lengths of lines passing through wild and desolate country. More recently, however, electric lighting, trolley systems, and the transmission of power have made their appearance; so that a local engineering section has not only a reason for being fostered, but also a reason for setting to work.

The Light-Flux of Arc Lamps.

In the June number of the *Bulletin* of the Société Internationale des Électriciens appears an interesting paper by M. Paporte on certain photometric measurements made upon arc lamps. With measurements of arc lamps our books are already well filled, but these measurements are particularly interesting, because they arrive at the essential results and express those results in terms of flux of light instead of in candle-power. The arc lamps to be used were placed in a lumenmeter consisting essentially of a hollow sphere with a pair of 18 deg. sectors cut out. The light emitted through these two sectors was thrown on a screen of blotting paper by a pair of suitably shaped and supported mirrors, and the illuminated blotting paper became a secondary standard of illumination, emitting a luminous intensity proportional to the total flux emitted by the arc lamp, on the supposition that the light from the two sectors was the average of all sectors; or, in other words, that the distribution of the light in azimuth around the arc was sensibly equal to the average distribution between these two sectors.

The general results obtained were that the flux of light emitted by the arc lamps increased faster than the power absorbed, that the flux for the same current strength increased steadily up to about 50 volts pressure, and then diminished. The specific flux, or flux per watt, absorbed by the lamp reached a maximum at about 41 volts, so that with these lamps a 41-volt pressure was the most economical pressure for light production. The reasons for the presence of this maximum are substantially those supplied by Mrs. Aryton in her memorable paper last year; namely, that with small pressures, and correspondingly small distances between the carbons, the flux of light is throttled or imprisoned by the lower carbon, while for greater pressures, and wide intervening distances between the carbons, the vapor of the arc is semi-opaque and absorbs much of the light. Consequently, there is a certain critical pressure and distance between the carbons at which the light per watt is a maximum. The specific flux varied in different trials and different distances separating the carbon from 5 to 14 lumens per watt, which is, on being interpreted into the vulgar, approximately from 0.9 to 2.5 watts per British spherical candle.

The special advantage of the method of measurement here recorded is the specification of the lamp in terms of its light. Thus an arc lamp may be defined as emitting from 1000 to 8000 lumens, and it is certain that a specification of a 6000-lumen lamp is far preferable to a specification of a 2000-cp lamp, the 2000 candles being a maximum value and the 6000 lumens a sum total of light emitted. The paper shows that a 450-watt lamp can have a specific flux of anywhere from 6 to 15 lumens per watt according as the pressure falls from 65 to 40 volts, but at 45 volts and 10 amperes a 450-watt

lamp would give 13.5 lumens per watt, or 6075 lumens in all. The resistivity of the carbons employed varied between 0.0057 and 0.0073 ohm centimetres. Some results were obtained with lamps 3 in series on 110 volts. It was found that with three in series each lamp gave 2800 lumens, or a total of 8400 lumens between them, while with another set of two in series, under 110 volts, 3900 lumens each, or 7800 lumens between them. The current in both cases was 8 amperes. Consequently the triple series lamps were the more efficient. The specific flux was 9.55 lumens per watt for the triple series lamps.

It is greatly to be hoped that a similar method of measuring and comparing the comparative values of arc lamps may come into general use. The maximum candle-power of a lamp is of secondary importance compared with the total quantity of flux of light which the lamp will deliver. We think it should be borne in mind, however, that although the light emitted by the arc lamp is of much more importance than its luminous intensity in a favored direction, yet the value of the arc lamp to the purchaser is not in strict proportion to its light-giving power. Any estimates which base the value of an arc lamp merely upon its light-giving powers will be commercially fallacious. The fact is that an arc light often gives more light than is really needed, and consequently the finish and appearance of an arc lamp, its convenience, its duration of carbons and a number of such little details, have often a greater influence with the purchaser than either the lumens or the candles, even if the purchaser is fully alive to the latter qualifications.

RAPID TELEGRAPHY.

The average practical telegraph engineer has a deep-rooted distrust of rapid telegraphy, including in that class any and every system which requires the transcription of messages to fit them for automatic transmission. The old original Morse, only slightly modified for convenience, has held its own in a fashion that is little short of marvelous. Improvements have come and improvements have gone, but the hand key of half a century ago still dominates the art. Of course, in much telegraphic work the operation of transmission is greatly shortened by conventional abbreviations forming a species of code, but the process remains essentially the same. Every one admits the desirability of increased speed, enabling a single wire to do the work of half a dozen, but there is a general dread of the ensuing complications both as to apparatus and methods. Both here and abroad the Wheatstone system has come into some use on important lines, but it has by no means taken the place that at one time seemed probable. Inventors are wonted to lay the non-success of rapid systems at the door of the telegraph monopoly, declaring that its cautious conservatism has impeded the experimental adoption of various more or less promising systems. On the other hand, it is contended that the great telegraph companies of the world are not in business for their health, and that a change in the art that would afford an opportunity for increased profits would assuredly not be unwelcome. The conservative element will even admit that the apparatus of some of the rapid systems has been beautifully worked out, and is by no means forbidding in its complication, so that failure in the technical sense cannot fairly be cited as a valid reason for non-success in practical operation.

It will not be without interest, therefore, to consider the question from the standpoint of those who view rapid telegraphy with disfavor. One of the objections offered is that such systems have a certain unwieldiness, pertaining rather to the systems as a whole than to their technical operation. In sending a telegram there is a certain amount of lost motion. The message is written upon the blank, turned in, and then passed along to the operating room, and put on the operator's hook. In due season it is sent over the wire, transcribed on a typewriter at the receiving station, and is then passed over to the delivery system. The total time taken in this process is mostly occupied with other things than the transmission itself. As a matter of practice it may take an hour, more or less, to get the message from the sender in New York to the receiver in, say, Washington. On the average, the transmission only takes a minute or so, and the remaining 59 minutes are devoted to delivery and to waiting, including the time taken to get the message to the sending office. No actual shortening of the time of transmission can save directly any material time in ordinary business messages. With the Wheatstone system the message might actually be sent in, say, two seconds, again entirely trivial from the standpoint of the public. A far greater gain can be made in the increased capacity of lines, giving a short wait prior to transmission. But on any automatic system the written message must await its turn at the perforating machine, and in systems like the Wheatstone it must also await its turn for transcription, which lessens, or even quite negatives, the advantage gained by added capacity of the lines. And a telegraph boy will not put on more pace for an automatically sent message than for any other. As a result of these conditions it is held that there can be no heavy pressure of public opinion to force the adoption of rapid telegraphy, that the real gains are in a somewhat lessened operating force and in increase in line capacity, which are felt inside the telegraph company rather than by the public; that a great increase of speed, say, to several thousand words a minute, would not affect any except a very small number of trunk lines, and would not be felt by the public at all.

From this standpoint, improvement should be looked for in the direction of automatic reception in printed form even at rather moderate speed, more than in a greatly quickened rate of transmission. This eliminates one step of the operating process entirely, and effects a material saving both in time and money. Practically, printing on a tape is objectionable, so that automatic page printing is the real desideratum. This has been successfully accomplished in more than one apparatus, and, as may be known to some of our readers, the beautifully ingenious Buckingham system has been in steady commercial use on one of the most important trunk lines in the country for many months past. The automatic delivery of messages neatly printed on regular blanks ready for distribution is a most important step, but the original transcription of the message into the form of perforated tape still remains rather a stumbling block. A perforating machine capable of being worked at any considerable speed is not a simple affair, and while it can in practice be worked much faster than a Morse key, it has been held to be an inconvenient necessity. In certain classes of work, such as press dispatches, it might be possible to prepare tape outside of the telegraph office, but the objection is made that such a process has its limitations—a rapid telegraph system being likened to a four-track railway, which needs heavy traffic to bring out its economic value. To a certain extent it may be able to build up its own traffic through increased facilities, but under the present organization of the telegraph industry there seems small chance of the tariff being put down to a point that will justify very extensive use of the service for general communication. It is admitted that possibly in the event of a postal telegraph system being established, rapid telegraphy might come into far more extensive use than seems likely under present conditions, but save for some such contingency its functions, while highly important, seem likely to be confined within rather narrow lines. As we have frankly advocated rapid telegraphy, we present the above statement of the other side of a question which is progressively assuming more importance.

Buffalo Meeting of the American Institute of Electrical Engineers.

At the meeting last week of the Council of the American Institute of Electrical Engineers a preliminary programme was adopted for the annual convention to be held in Buffalo, and for several days preceding the meeting of the convention. The Institute will meet at the house of the American Society of Mechanical Engineers at 12 West Thirty-first Street, New York, on Wednesday, Aug. 14. There will be an address of welcome to foreign guests, a collation, registration of names and distribution of badges. On Thursday visits will be made to the Crocker-Wheeler Works, the power stations of the Manhattan and Metropolitan railways, with dinner at Hotel Marlborough in the evening. On Friday, the Eighteenth Street exchange of the New York Telephone Company will be visited, and the power plant of the New York and Brooklyn Edison companies. For Saturday there are no assignments. On Sunday, Aug. 18, the party will proceed on the special steamboat "Montauk" to Albany, arriving at that place at 6 p. m. The party will be met at the wharf by special street cars and taken to the Hotel Ten Eyck, where dinner will be served and the night passed. On Monday it will leave by special train for Schenectady at 8.30 a. m., where a visit will be paid to the works of the General Electric Company. After luncheon at the works the party will proceed by special train to Buffalo, arriving there at 8 p. m. Special arrangements will be made for conveyance from the train to the Hotel Niagara, whic. will be the headquarters of the members during the convention. The sessions of the convention will be opened on Tuesday morning in the New York State Building on the Pan-American grounds. An address of welcome will be delivered by the Mayor of Buffalo. The afternoon and evening will be devoted to a preliminary tour of the Exposition. It is expected that only morning sessions of the convention will be held, the afternoons being utilized as may be arranged by the Buffalo local committee, including a trip to Niagara Falls, visits to electrical stations in Buffalo, etc. The fare for the trip from New York to Buffalo and return will be $16, which will include transportation on the boat with luncheon and refreshments, and transportation on the train the next morning from Albany to Buffalo. This will also include the privilege of sending heavy baggage from anywhere in New York or Brooklyn, and its delivery to a hotel room at Buffalo. A delegation of French engineers will be among the party. General topics for discussion at the convention have been selected for each day, upon which brief abstracts of papers will be presented as follows: On topics relating to Meters and Metering of Electric Energy, by Harry P. Davis, Caryl D. Haskins, Paul M. Lincoln and William Stanley. On topics relating to Electric Transmission Systems, W. S. Aldrich and H. W. Redfield, William Hand Browne, F. A. C. Perrine, E. W. Rice, Jr., Charles F. Scott, Charles P. Steinmetz, and "A Description of Niagara Falls Transmission Plant," by L. B. Stillwell. On topics relating to the Supplying of Light and Power in Large and Small Cities, L. A. Ferguson and William Lispenard Robb. "The Nernst Lamp," by Alexander Jay Wurts. On topics relating to Electric Railroading, by A. H. Armstrong, E. J. Berg and others.

Electrical Engineers of the Day—V.

H. G. STOTT.

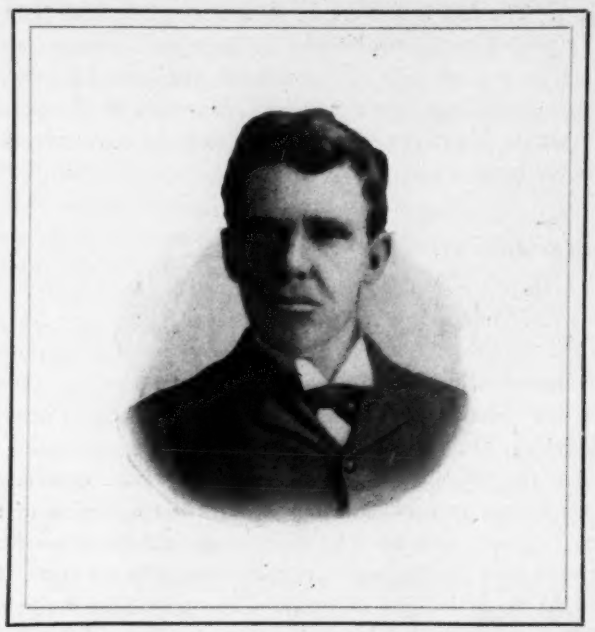
Henry Gordon Stott, the son of the Rev. D. Stott, was born in the Orkney Islands, the extreme northern county of Scotland. He received the greater part of his early education from his father, and was sent to the Watson College School, in Edinburgh, and the following year to the College of Science and Arts at Glasgow, later consolidated with similar institutions into the Glasgow and West of Scotland Technical College. After three years' study in the engineering, electricity and chemistry classes, he started in with a small electric light company in Glasgow in October, 1884, where he became familiar with the practical part of central station work requiring more muscle than brains.

In May, 1885, through the kindness of Professor Jamieson, he was appointed assistant electrician to the Anglo-American Telegraph & Cable Company, which position he held until October, 1889, during which time he assisted in over 70 cable repair expeditions.

Much of his spare time was taken up in experimental work on the self-inductance of iron-armored submarine cables, and developing new methods for locating faults. He spent many nights in work on the duplexing of the Direct United States Cable Company's main cable, this being the longest cable ever successfully duplexed, receiving a letter of thanks from the general manager in London for his voluntary work, which was, however, interrupted by a call to the other side of the Atlantic, the work being completed by the cable company's own staff in Halifax, N. S.

Realizing in 1889 that the future of telegraphy was a limited field compared to that of power and light, he resigned his position in London and accepted a position with the Brush Electrical Engineering Company, going to Bournemouth, England, for a year as assistant engineer in its lighting plant. After a year there he went to Madrid, Spain, and was engaged in the erection of engines, generators, underground systems, the wiring of many of the Spanish grandees' mansions and part of the Senado or Senate Chamber. From Madrid, at the expiration of the contract, he returned to the Brush Electrical Engineering Company in London, and was engaged in general engineering work on the chief engineer's staff.

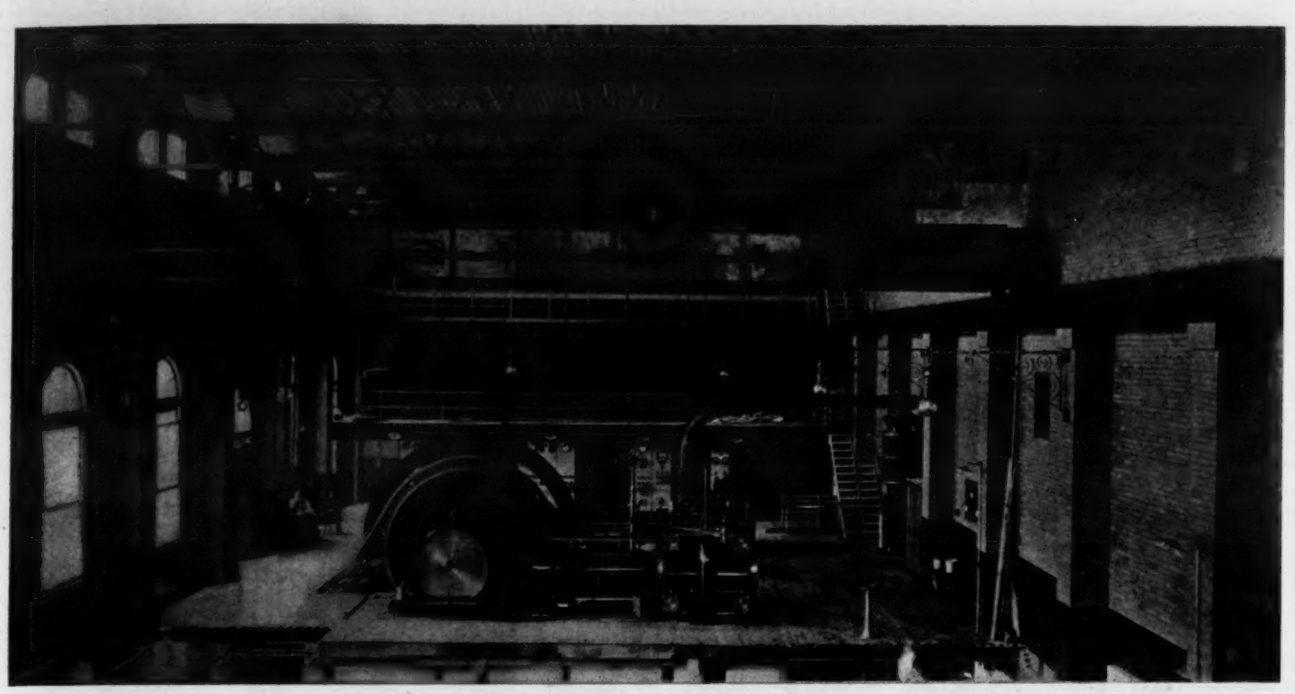
In September, 1891, realizing the small opportunities for promotion in electrical work in Great Britain, he left for New York and was there immediately engaged by Mr. C. R. Huntley, of Buffalo, N. Y., to put down the first underground cables ever used in that city for lighting and power purposes. During the ensuing years he was engaged in the various kinds of installation work connected with the replacement of small generators with large, laying underground cables, installing new switchboards, in lamp and meter work, etc., two of the plants operated by the Buffalo General Electric Company



having been gutted with fire, necessitating a complete new outfit of electrical apparatus.

In 1897 the company decided to close a contract with the Niagara Falls Power Company to supply it with electric power to take the place of steam and to consolidate the two existing plants into one new one, which would be a model in efficiency, reliability and economy of operation. The design of this entire plant, together with the storage battery auxiliary, was entrusted to Mr. Stott, in addition to his other duties. The new plant at Seventh and Wilkeson Street, testifies to the fact that he carried out his instructions as to efficiency, reliability and economy of operation, for with a total of 14,000 horse-power in motors and generators, not a single shut down of any part of the service was caused by any fault in the plant itself, in two and a half years, and further, the station is operated by two men on a watch. When it is realized that this plant receives three-phase 25-cycle currents, and sends out four different kinds, namely, 60-cycle, constant-current arc, three-wire Edison and 500-volt direct-current power, with the necessary complication due to previous conditions, the record is marvelous.

In February, 1901, after nine and one-half years' service with the Buffalo General Electric Company, Mr. Stott was offered and accepted the position of superintendent of motive power of the Manhattan Railway Company, New York, to take charge of its new 70,000-hp generating plant and seven sub-stations, as well as of the entire distributing system. Mr. Stott is a member of the American Institute of Electrical Engineers, before which body he read a paper this spring on "The Distribution and Conversion of Niagara Currents at Buffalo, N. Y."



DYNAMO AND ENGINE ROOM, TOLEDO-MONROE ROAD.

The Toledo, Ohio—Monroe, Mich., Interurban Railway.

The Toledo section of an interurban railway which is eventually to extend to Detroit, Mich., was completed several months ago, and is now running a regular hourly schedule over a distance of 18 miles. The schedule speed is 38 miles an hour, with an average number of stops of two per mile.

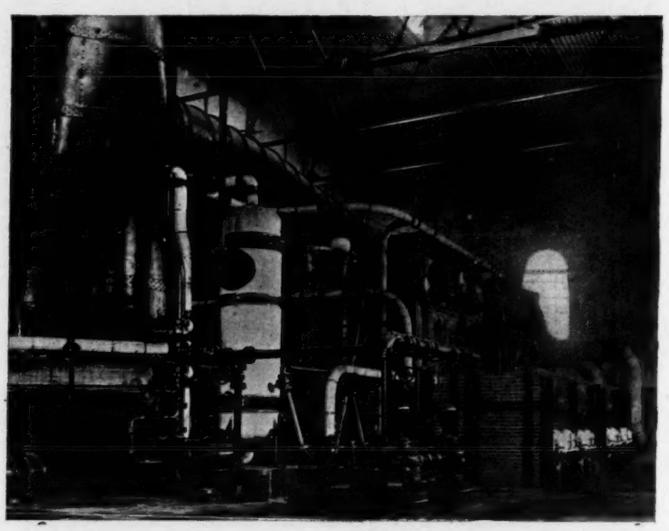
The accompanying illustrations show the power house, which is located in Toledo, and the upper floors of the sub-station, which is 12 miles distant from the latter city.

In the power house are two 400-hp triple-drum Babcock & Wilcox boilers, designed for 160 lbs. pressure, but at present worked at 135 lbs. Three-phase currents are generated and transformed for the railway circuits to direct current by means of rotary converters. The generator is a 400-kw, 25-cycle, revolving-field Westinghouse three-phase machine, and is driven by a compound condensing, heavy-duty Hamilton Corliss engine, the latter being rated at 600 ihp. at a speed of 100 r. p. m. For transmission to the sub-station the generated voltage of 380 volts is stepped up to 15,000 volts by means of three 135-kw Westinghouse transformers. In the power station is a Westinghouse rotary of a capacity of 200 kilowatts, which converts the three-phase current generator to direct current at about 620 volts.

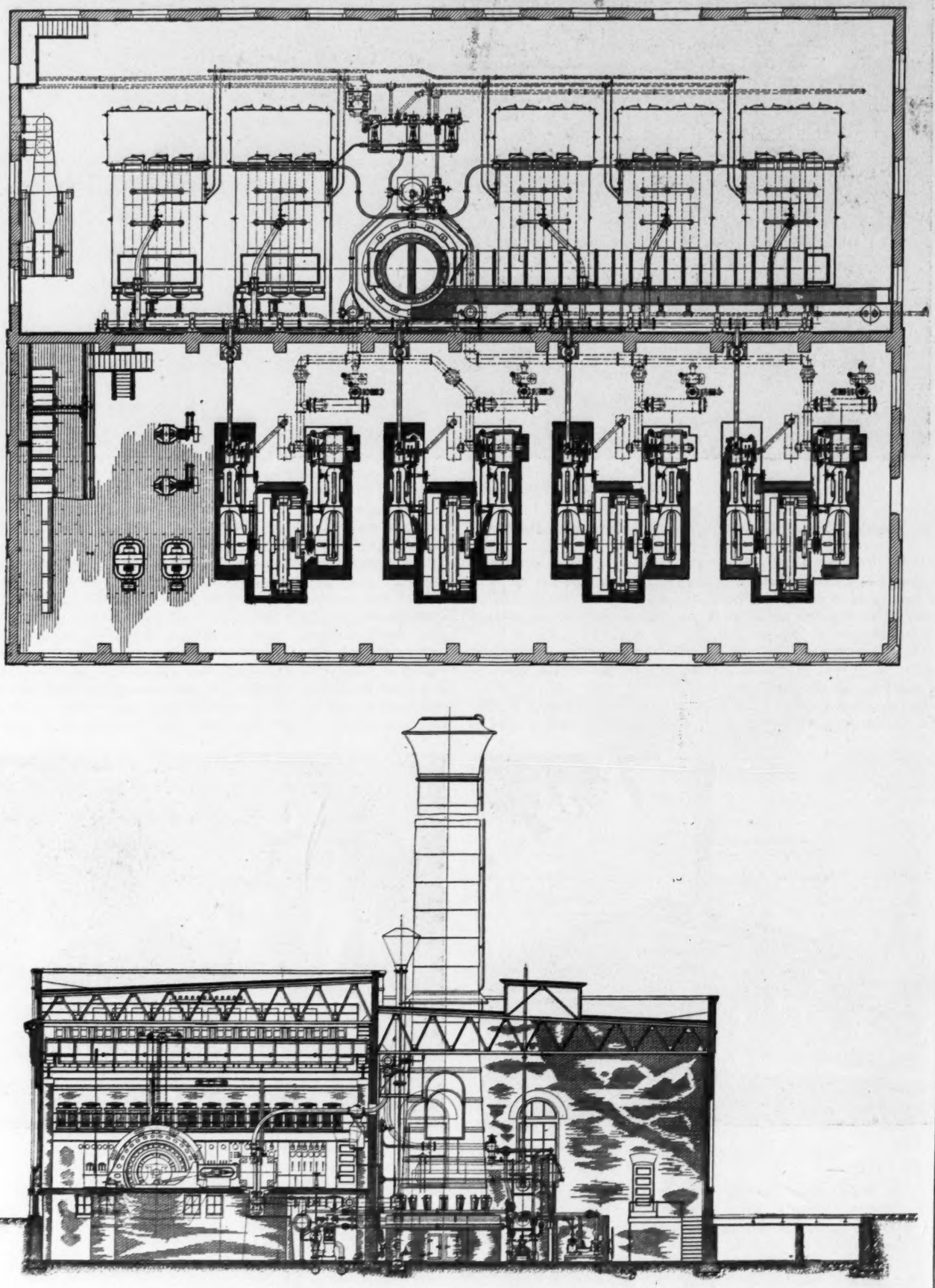
The alternating-current rotary panel of the station switchboard contains a triple-pole switch for the induction motor carried on the end of the rotary shaft, a triple-pole, single-throw, 400-ampere, spade-handle switch for the rotary itself, and a double-throw, single-pole switch which connects the field of the rotary in either short or long shunt. This last-named switch is used when the rotary is started from the direct-current end. It is first thrown to short shunt and the rotary brought up to speed as a shunt motor by gradually cutting out the resistance in a starting rheostat, which is in the main circuit. When up to speed the positive rotary switch is thrown in and the starting rheostat circuit opened. The speed can then be varied by means of the field rheostat giving a visible effect on the synchronizing lamps, and showing when to throw in the alternating-current rotary switch.

The other method of starting the rotary from the alternating-current end requires the shunt switch to be left at long shunt, as though the rotary were a direct-current generator. The speed is raised by the induction motor, and when the lamps synchronize the alternating-current switch is closed. Preventive coils are connected

POWER HOUSE, TOLEDO-MONROE ROAD.



BOILER ROOM.



Elevation and Plan, Toledo-Monroe Interurban Railway.

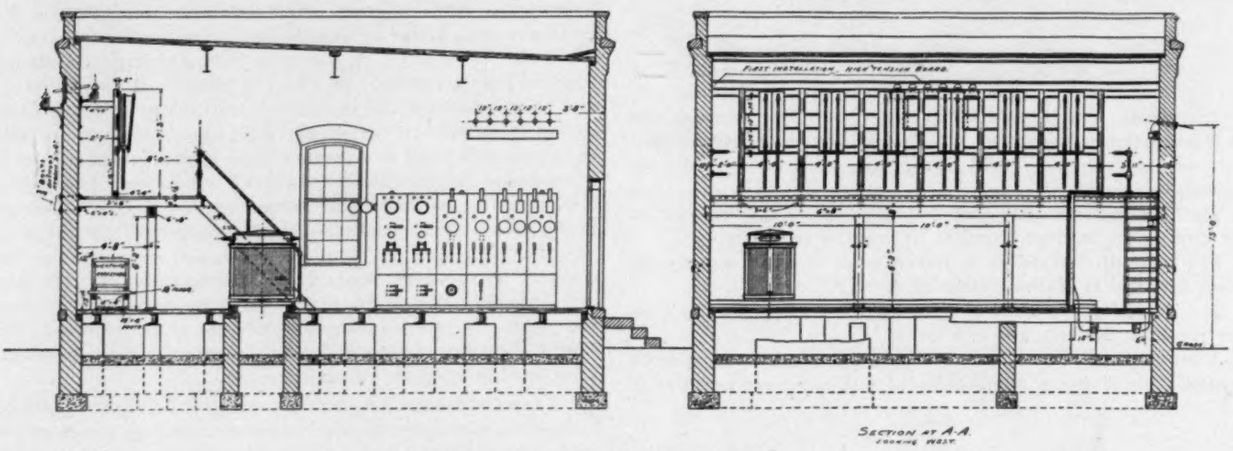
INTERIOR OF SUB-STATION.

across the shunt switch to avoid the flash discharge which would occur were the field circuit opened.

There are two sets of bus-bars, one of which is connected with a set of three auto-converters, which add 20 volts to the e. m. f. generated.

In the sub-station there are three transformers and two rotary converters of the same size as those in the power house.

The rolling stock consists of four passenger cars, one chair car, one combined passenger and baggage car and one freight car. The passenger cars are 40 ft. long, with a smoking compartment at the forward end. Electric heaters are wired under each seat. The electric equipment is of the four-motor type, 50-hp Westinghouse motors being used. The road was built by the J. G. White Company, under the direction of its engineer, Mr. Sumner W. Childs.



ELEVATION AND PLAN OF SUB-STATION.

Independent Telephony in Toledo.

The greatest victory for the independent telephone companies in Ohio, in some time, is said to be the securing by the Toledo Home Telephone Company of a franchise to build a local system. The company was promoted by Mr. Frank Graves, backed by Cleveland and Toledo people, and for some months it has been engaged in a struggle with two rival companies. Several weeks ago, after finding it impossible to gain any satisfaction from the city council, the company applied to the Probate Court which finally granted the franchise. The new company had secured over 3500 subscribers, and the Court was impelled to answer its demands. The company produced witnesses from every town in northwestern Ohio who declared they were turning their business to Cleveland and Indianapolis, because they could not secure good long-distance telephone connection with Toledo merchants. This is the last of the larger cities in Ohio to secure independent service. Toledo already has two systems, and for that reason it was extremely difficult to secure the franchise. The Bell company, it is said, has only about 1200 subscribers, while the Harrison Company, which is supposed to be controlled by the Bell company, and is not recognized by the independents, has only about 500. The Toledo exchange forms a most valuable addition to the independent interests in Ohio, as it will be a means of giving them first-class connection between the systems of Ohio and Michigan.

Exports to Central and South America.

Exports from the United States to all American countries and islands south of her boundaries show a marked increase in the fiscal year just ended, and exceed those of any other year in the history of our commerce. This statement, just announced by the Treasury Bureau of Statistics, is especially interesting in view of the various efforts being made for closer business, commercial and transportation relations between the United States and her neighbors at the South. New lines of steamers have recently been put on between the Pacific Coast of the United States and the western coast of Mexico, Central and South America. A recently published statement indicate that great financial interests of the United States have obtained control of the nearly completed transcontinental line connecting Argentina with Chile. The establishment of additional direct steamship lines between the Eastern coast of the United States and South American ports is under discussion, and the opening of an isthmian canal would give a straight line of water communication from the Eastern coast of the United States to the Western coast of South America. All of these movements in the direction of closer relations between the United States and her neighbors at the South add interest to the announcement that our exports to those countries in 1901 are larger than those of any preceding year, and to some figures just presented by the Bureau of Statistics showing the imports of each of the South American countries at the latest date and the exports from the United States to each of those countries in 1901.

The growth of exports from the United States to Central and South America has not kept pace in the past with the growth in other directions. The total exports to South America in 1900, for instance, were no more than those of 1890, being in each of those years, in round numbers, $38,000,000, while the same statement holds good with reference to Central America, the total exports from the United States to the Central American States being in 1890 and 1900 in each case in round numbers, $5,000,000. It is to Mexico and the West Indies that our exports in the decade 1890-1900 show the greatest increase, being: To the West Indies in 1890, $33,000,000, and in 1900, $47,000,000; and to Mexico in 1890, $13,000,000, and in 1900, $34,000,000. The fiscal years 1900 and 1901 show a much greater increase in our sales to our neighbors at the South than in any preceding years. The total exports to Mexico, Central and South America and the West Indies in 1899 were $103,000,000; in 1900, $127,000,000, and in 1901, $138,000,000, in round numbers. Thus the figures of 1901 are $35,000,000 greater than those of 1899, while the 1899 figures are only $1,000,000 greater than those of 1893.

Wireless Telegraph Experiments Between Brussels, Malines and Antwerp.

By Emile Guarini.

DURING the months of January, February and March, of the present year, I was enabled, with the assistance of Artillery Lieutenant Fernand Poncelet, to carry on some experiments in wireless telegraphy between the Column of Congress, Brussels, the Tower of St. Rombaut cathedral at Malines, and the Tower of Notre Dame cathedral at Antwerp, the Belgian Government having kindly placed these monuments at my disposition for the purposes of

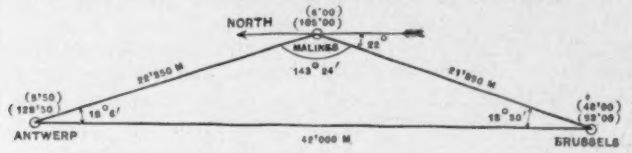


FIG. 1.

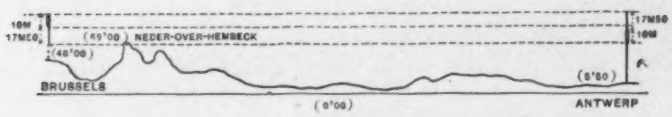


FIG. 2.

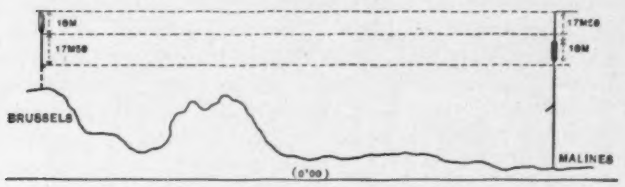


FIG. 3.

FIG. 4.

the experiments. The respective distance of these monuments from each other and their heights are indicated in Figs. 1 to 4, the heights being referred to the sea level. The general programme of the experiments was as follows:

1. The transmitter installed at Brussels and at Antwerp not to affect directly the receiver placed at Antwerp or at Brussels.

2. The transmitter installed at Brussels not to affect directly the receiver installed at Malines, and vice versa.

3. The transmitter installed at Antwerp not to affect directly a receiver placed at Malines, and vice versa.

4. A repeater was installed at Malines, and the extreme stations at Brussels and Antwerp, being provided with apparatus as stated in

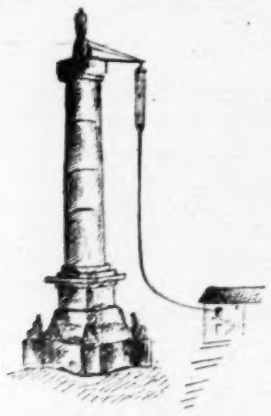


FIG. 5.

FIG. 6.

(1), Antwerp could thereby receive signals transmitted from Brussels, and vice versa.

In the first three cases I was at the first station and Lieutenant Poncelet was at the second. In the fourth case, we were both at the Malines station to observe the working of the repeater, assistants being stationed at the extreme stations. The signals were transmitted according to a programme fixed in advance in minutest detail. The watches of the observers were well regulated, and in the fourth case a Morse receiver was connected with the repeater and after each experiment its record was compared with the Morse record at the receiving station.

1.—DIRECT SIGNALING BETWEEN BRUSSELS AND ANTWERP.

Fig. 2 gives a section of the ground between the Congress Column at Brussels and the Tower of Notre Dame Cathedral. Figs. 5 and 6 show the aerial conductors attached to these monuments. In these last two figures the heights are not relative.

The aerial conductors were secured to bamboo rods securely fixed at the top of the monuments, and the portions of the conductor visible from the respective stations were run as nearly vertical as possible, the remaining portion being run obliquely to the receiving posts. At Brussels the receiving station was in a house on Rue Van der Meulen, and at Antwerp in a hotel on Place Verte. The vertical or useful part of the conductor in each case had a height of 90 ft. (27.5 meters) above the summit of each station. It consisted of a single cable of seven .9-mm wires 57 ft. (17.5 meters) long with a cylindrical portion 33 ft. (10 meters) long, consisting of 50 parallel .4-mm wires, the cross section being 50 cms. At Brussels the cylindrical portion was at the top, and at Antwerp at the bottom of the useful part of the aerial conductor.

Each station was supplied with a transmitter and a receiver, the latter apparatus included a Morse recorder. The coherers were of the metallic filing type. All the various types were tested and a Blondel receiver found to be the most sensitive. The transmitting apparatus comprised an induction coil giving a spark up to 10 inches. Current was furnished from 8 storage batteries, the strength of the current being from 6 to 9 amperes. The power of the transmitters and the sensitiveness of the receivers were carried to the maximum of which the apparatus was capable, this in the case of the transmitters corresponding to current of 9 amperes and a spark of .6 inch.

Of all the signals transmitted from Brussels in the first trial none were received at Antwerp. The same is true of the signals transmitted from the latter place, with the exception of a trial when a current of 10 amperes was used. On this trial two signals were received at Brussels. After different tests, notably one to assure that the coherer was not affected by neighboring electric tramway lines, it was concluded that the two signals came from Antwerp. At the instant when they were received, after having interrupted the grounded current of the induction coil at Antwerp, two sparks 10 inches long and lasting 30 seconds were produced. This experiment was not followed up, my aim not being to determine the maximum distance over which I could send signals without the ground connection. This result sufficed to assure us that if the transmitter and receivers were placed in the same normal conditions, using 9 amperes of current, a spark-gap of 1.5 cm, a normal earth connection and supersensitive Blondel coherers, we could not secure direct communication between Brussels and Antwerp. We reserve for future experiments with the repeater the possibility of communication with its aerial conductor discontinued, thus determining if during this interruption a signal can be exchanged between the extreme stations.

2.—DIRECT COMMUNICATION BETWEEN BRUSSELS AND MALINES.

A.—Brussels transmits and Maline receives. Fig. 3 shows a section of the ground between the two stations and Fig. 7 shows the aerial conductor at Malines attached to the summit of St. Rambaut Tower, the aerial conductor at Brussels remaining as in the first experiment.

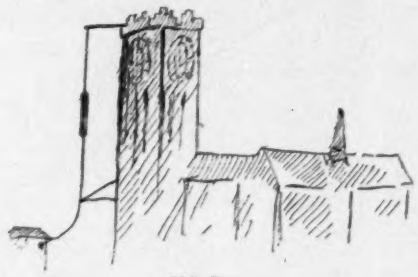


FIG. 7.

FIG. 8.

The apparatus at Brussels is the same as was used in the first experiment. That at Malines was the same as the apparatus at Antwerp, and was installed in front of the cathedral in the Breda Hotel. The experiments led to the following conclusions:

a.—The earth connection to the transmitter and receiver being

broken, all the signals transmitted were received. A current of 4 amperes and 16 to 17 volts was used.

b.—A storm having detached the aerial conductor at Malines, it was replaced in such a manner that the cylindrical portion was on a level with the roofs of houses in Brussels. Though the conductor at Malines had a height of 131 ft., communication was interrupted.

c.—The aerial conductor at Malines having been replaced by a single cable of seven 1-mm wires, starting from the height of the tower, it was found necessary to carry the current to 6 amperes in order to obtain communication.

d.—The lower part of the twisted cable at Brussels having been replaced by a cable of seven 1-mm wires in contact but not twisted, communication was established with a current of but 3 amperes. The result of these experiments and their concordance with the theory of the aerial conductor which we submitted in 1900 to the Academie des Sciences, of Paris, substantiates the principle that the aerial conductor radiates electrical energy exclusively in planes normal to its surface. The maximum effect will, therefore, be obtained with a conductor in the form of a vertical cylinder of a definite height and section, the conductors of each station being parallel and of the same height above a datum plane.

B.—Malines transmits and Brussels receives. At the beginning of this experiment a storm blew down the aerial conductor at Brussels. When it was re-established, for the cylinder of 50 wires a cone of 50 .4-mm wires of the same height was substituted, the base of the cone being at the top (Fig. 8). Thereafter to the end of the experiments the conductor at Brussels remained as shown in Fig. 8. The conductors at Malines and Antwerp were identical and consisted of a single cable of seven 1-mm wires. This set of experiments led to the following conclusions:

a.—In general, the communication was better than in the first set of experiments. At the beginning only occasional signals were received. This result was attributed at first to the form of the aerial conductor, since the parts serving principally for reception (the conical part) was less favorable; in addition, the presence of large quantities of metal which ornament the Congress Column (a bronze

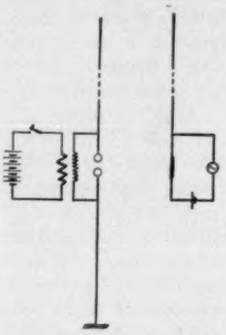


FIG. 9.

statue of Leopold I, four statues in bronze, two lions in bronze. etc.). A similar result had previously been observed in Paris during experiments between the Pantheon and Eiffel tower, in this case no message being received at the latter station while the reception was good at the Pantheon. This result was attributed to the effect of the iron in the Eiffel tower.

b.—In operating the transmitting and receiving apparatus at the maximum of their capacity and sensibility, communication could be established relatively well. The maximum number of signals were received when the vertical plane containing the two conductors was so established that it did not cut portions of the respective monuments supporting the conductors.

c.—Several experiments were made relative to earth connections. The best result was obtained in the case illustrated in Fig. 9 where the receiver earth connection was suppressed.

My conclusion from these experiments is that in wireless telegraphy the earth plays the part of the large capacity.

3.—DIRECT COMMUNICATION BETWEEN MALINES AND ANTWERP.

A.—Malines transmits and Antwerp receives.

a.—Good results were obtained with a current of from 2 to 2½ amperes.

b.—With the arrangement shown in Fig. 8 the results were not so good as with the inverse arrangement ($2°$—B—c). This experiment has not changed my opinion as to the role of the earth in wireless telegraphy, for at Brussels the receiving conductor was supplied with a large capacity at its upper end, a similar cone of 50 wires not being used at Antwerp. A section of the ground between the two stations is shown in Fig. 4.

c.—An interesting experiment was made on the employment of alternating-currents in wireless telegraphy. The oscillator was suppressed at Malines, and the aerial conductor connected to earth through the secondary of the induction coil. Twenty-five per cent of the signals transmitted under these conditions were received at Antwerp.

d.—A signal was received at Antwerp when the receiver earth connection there was disconnected, alternating currents being used at Malines.

B.—Antwerp transmits, Malines receives.

a.—Less favorable results were obtained than in the inverse communication. A strong wind bent the aerial conductor at Antwerp and destroyed the parallelism between the two conductors, thus furnishing another proof of my theory as to the role of the aerial conductor.

b.—Under the same atmospheric conditions, the results attained were most favorable when alternating currents were employed.

c.—The results were still better when a capacity was added to the end of the transmitting conductor.

d.—The Marconi method of syntonizing was tried. With complete diaccord, and though the distance was more than 2½ kilometers, exchange of signals could be maintained almost as well as with complete tuning.

Apropos of recent wireless telegraph press dispatches, we learn from the newspapers that notwithstanding the precautions taken during the Marconi experiments near Nice, a dispatch transmitted from Biot to Calvie was intercepted at Ville Franche in its entirety and with perfect distinctness. This confirms the result just referred to.

4.—COMMUNICATION BETWEEN BRUSSELS AND ANTWERP, A REPEATER BEING EMPLOYED AT MALINES.

The three preliminary experiments having given the desired results, I was enabled to undertake the final experiment, which was to demonstrate the value of my automatic repeater for transmission over great distances. In my laboratory experiments this apparatus has always operated perfectly, but it was my desire to test it over long distances.

This apparatus is operated by very feeble waves, and acts as a relay to send forth waves of great energy. The experiments were crowned with pre-eminent success. On the last day of the experiments the time of sending the signals was noted at each station and subsequently

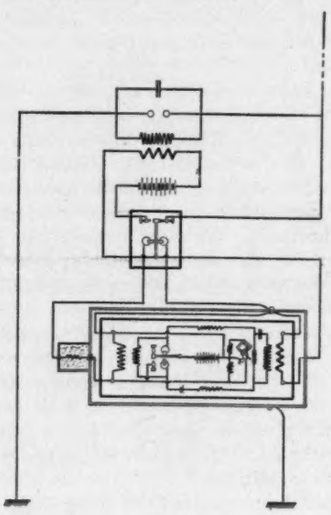


FIG. 10.

the Morse records at the two stations were compared and a perfect identity was found. All the signals transmitted from Brussels were not received at Antwerp, but this latter station received every signal which passed by Malines, which demonstrates the absolute fidelity of the repeater.

The repeater experimented with at Malines is shown schematically in Fig. 10. A single aerial conductor was employed at Malines and

connected with the secondary of an induction coil. The relay switch had for an object to maintain or interrupt communication with the receiving mechanism according as it operated as a receiving or transmitting conductor.

The result of some experiments led us to interpose a transformer with a glass core and a condenser, between the aerial conductor and the coherer. It was noted that without this precaution the atmospheric electricity gathered by the conductor at Malines, which acted, in fact, as a lightning rod, influenced the coherer at each interruption in such a manner that once set in operation by the wave transmitted from Brussels or Antwerp, it continued to function. The aerial switch had a second function, that of closing the primary of the induction coil. Its sensibility was about 1-20,000 ampere.

The coherer which gave the best results consisted of large nickel filings with traces of silver, enclosed in a 1-mm space, the tube being exhausted. To obtain perfect decoherence I used the following means: At the moment when the striker gave a shock a supplementary resistance of 2000 ohms was added to the normal resistance of 1100 ohms in the circuit of the coherer. The repeater operated automatically and in irreproachable manner, both with alternating and Hertzian waves.

The Mechanical Equivalent of Light.

BY C. J. REED.

WHEN we speak of the "candle-power" of a source of luminosity, we mean simply the intensity of the physiological effect produced by energy in a certain condition. The candle-power is not in any sense a measure of the energy. There seems to be no more reason for assuming the existence of a definite relation between the intensity of this physiological effect and the quantity of energy producing it than for assuming that a definite relation exists between temperature and quantity of heat. The temperature produced by a given quantity of heat depends on the quantity and kind of matter through which it is distributed, not simply on the quantity of heat. No one would think of speaking of the mechanical equivalent of temperature. We may compare one temperature with another by studying the effects of heat upon matter at various intensities and also by physiological effects. But we cannot say that a temperature of 100 degs. is equivalent to 1 foot-pound per second, merely because energy must be expended at that rate to maintain this temperature in a particular body under particular conditions. The same expenditure of energy in a different body or in the same body under different conditions will maintain a different temperature, and there is not necessarily any limit to the intensity of the temperature that may be produced and maintained by 1 foot-pound per second, provided the body acted upon its small enough and suitably conditioned.

For all we now know to the contrary, the same is true of luminosity. Light is not *energy*, but merely a physiological effect produced by energy in a particular condition. The intensity of this effect, or quantity of light, does not necessarily depend on the quantity of the radient energy producing it, but on the condition of that energy, and there is not necessarily any relation between the quantity of energy and its condition. We may compare one source of luminosity with another, but we cannot measure it, either in calories or in foot-pounds, though we may measure in foot-pounds per second the power required to maintain a certain luminous intensity in a particular mass of a particular substance under particular conditions of radiation, etc. We may also measure the radiant energy given off by a source of light, but that is not a measure of the light. It is only measuring the energy dissipated in maintaining a condition in matter. We can place no finite limit to the luminosity that may be maintained by the same expenditure of energy in a different mass or under different conditions.

There is no absolute standard of either light or temperature. Both produce physiological effects, which give us qualitative knowledge of intensities. Heat affects the properties of all matter in such a way as to give us approximate, but not absolute, standards of measurement. But there is no instrument for measuring light, except the living eye. There is no known change produced in any of the properties of matter by light. We may measure the actinic power of radiant energy emanating from a given source by an arbitrarily chosen photographic plate; and the heat, by an arbitrarily calibrated thermometer, but not the luminosity. The measurements of the actinic power of the same source are not comparable when different photographic materials are used. But even if they were, we would be no better off for measuring light, as light is not actinic power.

That the maintenance of luminosity is always necessarily accompanied by the dissipation of energy, there does not seem to be any room for doubt, as is also the maintenance of temperature. But this may be only because high temperature is necessary for the production of light. It does not imply a particular quantitative relation between the energy dissipated and either the temperature or the luminosity.

The investigations for determining the mechanical equivalent of light, of which Mr. Carl Hering has given an interesting review in the ELECTRICAL WORLD AND ENGINEER, of March 23, 1901, have resulted in determining, at most, only the radiant energy accompanying or causing an arbitrarily defined luminosity under particular conditions. There is no evidence, however, that this energy is the luminosity, or that the relations established under these conditons would hold true under other conditions, as, for example, at higher or lower temperatures. We have, on the contrary, most positive evidence that they would not.

According to the results of Tumlirz and Thomson (which differ by about 25 per cent) the magnificent light of the Cooper-Hewitt tube would come very near the theoretical limit of possible efficiency. Increasing the temperature of the incandescent vapor in this tube a thousand-fold would not, according to this supposition, materially increase the light-giving power of a given quantity of energy. But the results obtained by Ebert indicate that there is no such fixed relation between the quantity of energy and its light-giving power—in other words, that the luminous power depends upon the *quality* or condition of the radiant energy rather than its quantity.

The luminosity of the firefly is frequently referred to as "cold light," but this is only a guess. We have no evidence that this source of light is cold. The fact that the quantity of energy required for great luminosity of this kind is so small that it cannot be easily detected is no proof that the incandescent particles are at a low temperature. The temperature of the phosphorescent particles may be greater than that of the electric arc, and yet the mass of the particles may be so small as to be unweighable and incapable of affecting perceptibly any instrument for measuring temperature. We are, therefore, not yet warranted in assuming the existence of cold light.

The great efficiency of such sources of luminosity, as are usually designated "cold," may be really due to their very high temperature.

The glass tube containing the luminous Cooper-Hewitt vapor remains comparatively cold, but we are not, on this account, warranted in assuming that the particles of incandescent mercury vapor in the tube are also cold. Nor would we be warranted in such a conclusion even if a thermometer inserted in the tube and entirely surrounded by the incandescent vapor, should fail to indicate a high temperature. The actual temperature of this vapor may be many thousand degrees, yet a thermometer entirely surrounded by it could easily radiate energy as heat of low degree faster than it could receive energy by both radiation and contact, from the minute mass of the surrounding highly heated vapor.

Edison Storage Battery.

Our French contemporary, *L'Industrie Electrique*, contains in the current issue a letter signed by Louis Krieger, which, after referring to an article in that journal in which it was stated that the zinc-nickel storage battery had been patented in 1899 by Michalowski, claims that the writer had anticipated both Edison and Michalowski, he having been granted a patent Dec. 4, 1896, on a zinc-potassium-nickel storage battery, and also on the employment of lithium and magnesium with zinc in this type of battery. This battery, which is stated to have been entirely the result of an electrochemical calculation, was made during 1896, and one which was tested in the laboratory of Professor Lippmann at the Sorbonne showed an e. m .f. of 1.82 volts, which is exactly the figure arrived at in the calculation in assuming the reduction of sesquioxide (Ni^2O^3) to protoxide (NiO). The formation of the nickel positive is stated to be very simple if certain precautions are taken. Oxidation of the nickel can even be obtained on a plate of ordinary plate nickel carrying no active material.

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An American Review of Telephony Abroad.

A FEW weeks ago note was made in these pages of the evidence given before the United States Industrial Commission at Washington by Mr. U. N. Bethell, general manager New York Telephone Company, and an abstract was presented of his statements in regard to conditions in this country. During the latter part of the hearing Mr. Bethell was requested to furnish data as to the differences between telephonic conditions in the United States and in Europe, etc., and his evidence in respect to that branch of the subject was also of a most interesting and instructive nature. We are now able to present its salient points, which deserve the consideration of our numerous foreign readers not less than that of the large number engaged in telephony in this country.

In speaking of European conditions, to avoid confusion, Mr. Bethell expressed all money values in American equivalents, and in mentioning the populations of various places made his statements in even thousands. He has twice visited Europe personally for the purpose of looking into telephone conditions there, and in the fall of 1899 visited the countries of France, Belgium, Switzerland, Austria-Hungary, Germany, Holland, Denmark, Sweden and England. He then obtained from public documents and other reliable sources on the ground much of the information used in his testimony. Throughout his evidence Mr. Bethell was careful to state, in dealing with each country where there is governmental or municipal control, that what he regarded as poor service was not due to technical mismanagement, but sprang essentially from political conditions, which acted as a handicap upon the officials.

FRANCE.

As to France, he stated that a company operated the telephone industry there until 1889, and since that time it has been a Government monopoly. There has been practically no development outside of Paris. There are more telephones in New York than in the whole of France. At the beginnig of 1901 the population of Paris was 2,536,000, with 33,000 telephones, about 50 per cent of the total number in France. Only four other cities had more than 1000 stations. They compared with America as follows: Lyons, population, 466,000; telephones, 2207. Cleveland, population, 285,000; telephones, 8492. Marseilles, population, 442,000; telephones, 2151. Cincinnati, population, 325,000; telephones, 9142. Bordeaux, population, 256,000; telephones, 2009. Milwaukee, population, 285,000; telephones, 8492. Lille, population, 216,000; telephones, 1064. Louisville, population, 304,000; telephones, 5049.

There is relatively a very large development in Paris, due in a great measure to the inferiority of other means of communication. The rates are not relatively low. The Paris system is technically far behind the times. There are few modern appliances and much of the old apparatus used by the company before the Government took over the business is still in service. That the subscriber buys his own instrument, and that the Government has approved some 500 types of instruments from which the subscriber may select, gives some indication of the possible character of the service.

In Paris the company charged $120 a year. The Government has charged and now charges a flat rate, business and residence alike, of $80 a year. The rate will be reduced in 1902, in accordance with a law recently passed, to $60 a year, if the requisite plant can be provided by that time. In addition to the annual rate, the subscriber bears the cost of the instrument and a part of the cost of the line, i. e., from the underground cable in the sewer to the station, and if he is beyond the fortifications, he pays also for the line beyond that point. In towns outside of Paris, the rates range from $30 to $60. That these rates are considered high, taking into account the purchasing power of money in those places and the character of the service furnished, the figures already mentioned, showing an absolute lack of development, would seem to be sufficient proof. In Paris Government buildings are occupied by the telephone administration, and so far as the published accounts show no rents are charged for the occupancy. There are no charges for subways or rights of way, because the lines are in the sewers.

As to wages: Operators get about $6 a week; linemen and mechanics, $7.20 to $8.50, with 10 hours as a day. Separate telephone accounts are not published, so it is impossible to say whether the undertaking is self-sustaining or not. Considering the low wages and the freedom from usual charges, the Paris rate is relatively much higher than the New York rate, and considering the amount and character of the service, the annual rate plus the extra charges is also absolutely higher than the New York rate.

BELGIUM.

Belgium was next touched on by Mr. Bethell. The industry there was conducted by a company up to 1889 or 1890. Since then by the Government. At the first of this year, in all of Belgium there were 14,920 stations, or less than one-fourth the number in New York alone. In Brussels, with a population of 560,000, there were 4525 telephones; in Antwerp, population, 278,000, there were 2802 telephones. In general, the plant installed by the company before the Government took over the business in 1890, was still in use in 1899, completely out of date and almost worn out. Single wires or grounded circuits are still generally in use, although the conversion of a metallic circuit system has been commenced. In general the service, plant and methods are one with those that were abandoned in most American cities in the eighties. The company's rates for grounded circuit service have been continued in force by the Government; in Brussels and Antwerp, $50, the metallic circuit rate being $70. Elsewhere the rates range from $25 a year for grounded circuit service, and from $54 for metallic circuit service. Other things in Belgium are cheaper than telephone service. Labor is poorly paid. Operators get from $1.90 to $2.77 per week. The Government pays nothing for rights of way. The plant has been starved and is in poor condition.

SWITZERLAND.

Switzerland, Mr. Bethell said, did not properly come within the scope of his remarks, which were about large cities chiefly, but it is such an interesting country, telephonically speaking, because the Government controls the business, and it is so often referred to by writers on telephone subjects and others, that he felt it proper to say a few words about the conditions there. The population of Switzerland in 1900 was 3,300,000; of telephones at the first of this year there were 38,864. There are no cities comparable with New York as to size and general conditions. Zurich is the largest, with a population of 152,000, and only 6000 telephones. Private companies operated in some of the large towns at first, but these were bought out by the Government, and there is now a Government monopoly all over the State. The rates are uniform in all places without regard to differences in size. The subscriber pays for the first year $20, for the second year $14, and for the third and each subsequent year $8. These rates are, however, frequently quoted as if they told the whole story. These charges are only for the privilege of having telephone—the privilege of belonging to the State's telephone club, so to speak, and the subscriber must be near the central office to avoid extra line charges. Every time he uses the telephone he pays an additional charge. That additional charge is 1 cent for a local message. Four hundred at 1 cent makes $4, and that added to $20 makes $24, the annual charge during the first year for 400 local messages. Now, in many suburban towns, the New York Company has a rate of $24 for 400 messages, and gives a superior service to that given in the Swiss towns.

Mr. Bethell quoted here official statements by the director of the municipal telephone system in Amsterdam, Holland, showing that the Swiss rates usually quoted as inclusive or "flat" rates are, in fact, only minimum rates, and that the rates actually range as high as $158 a year, and possibly higher. The plant is cheap and inferior. Grounded circuits are still extensively used, and the equipment is quite out of date. Nothing is paid for rights of way except in a very few cases in one city, where the Government has not been able to break entirely away from a practice established by the private company. The Post Office collects the telephone accounts, and wages are exceedingly low. Skilled operators are paid $4; wiremen and chief operators in large central offices $7; linemen, etc., $4.20 to $6; foremen, $6.50 to $8.40 per week. The telephone accounts are separately kept and published. The national telephone receipts in 1899 were $1,007,011, the expenses $1,254,803, the deficiency $247,792. These figures will be found in the Statesman's Year Book for 1901. The expenses were practically 125 per cent of the earnings. That, continued for any time, would mean bankruptcy for a private concern.

AUSTRO-HUNGARY.

In Austria, several private companies conducted the business until 1894 or 1895. Since then the Government, after purchasing the plants of the companies, has operated the business as a government monopoly. As in France and Belgium, the chief development in Austria-Hungary has been in the principal cities—Vienna and Budapest. The Vienna plant was bought by the Government from the company

on a valuation fixed by experts, as shown by the public document covering the case, at $1,600,000. Possession was taken on Jan. 1, 1895. There were then between 7000 and 8000 stations. This is equivalent to $2000 or more per station. Either because of rapid changes in the art or because the plant taken over from the company was out of date, the Government soon after taking over the business began the construction of a new plant. They put up two very handsome buildings, laid out a comprehensive underground system and provided the offices with new equipment throughout, so that in 1899 there was very little, if any, of the company's old plant still in use. The Government up to that time had expended $1,200,000 on its new plant. The number of stations in all Austria at the beginning of this year was 31,902, of which 13,326 were in Vienna, whose population is 1,655,000. Chicago, with practically the same population, had more than twice as many stations.

The Vienna rate was $40 when the company operated the business, and that rate has been continued by the Government. Elsewhere in Austria the rate is $20 a year plus an installation charge or entrance fee, as they call it, of $40 per kilometre (⅝ of a mile) of line. The rates are thus relatively high enough to prevent development. They pay nothing for rights of way in Vienna. The wages are low. Operators receive from $1.80 to $3.40 per week; linemen, etc., about $5 per week. In the official documents relating to the transfer of the property from the company to the Government it was stated by the company that should it continue the business it would be necessary, in order to protect its stockholders and creditors, to raise the rate which was then $40. In Vienna the telephone has been a particularly unfortunate victim of Government ownership, not because of mismanagement or any misguided action respecting the telephone itself on the part of legislators. For several years there was no session of Parliament and consequently no appropriations were made for extension of telephone plant. The telephone business is peculiar in that it requires constant additions to its capital account, or it must stand still. That is exactly what happened in Vienna—growth stopped—through no fault of the telephone management or of any one in particular, but through the political troubles referred to, which had nothing to do with any telephone question. Their funds failed them, they had a large waiting list, and general dissatisfaction resulted.

There is another striking illustration of the same point—not in Europe, but in Japan. There, in Tokyo, where there is government ownership, growth was not exactly suspended, but the Government was not able to take care of the business that was offered—to furnish the facilities that the public demanded—and applications being dealt with in the order in which they were received, there arose a speculation in the rights of priority for connection, and those rights sold as high in some cases as seven times the annual subscription for the telephone.

In Hungary there is no development outside of Budapest worth speaking of. In Budapest there were at the beginning of this year 5796 telephones, with a population of 729,000. Excepting the two Russian cities of Moscow and Warsaw, Budapest has the lowest development in Europe or America among cities of from 500,000 to 1,000,000 inhabitants. Several American cities of one-half the size have more than twice the number of telephones—that is, more than four times the development.

In Budapest there is a very progressive people, but as to the telephone service their plant is antiquated, their service is inferior and their rates are the same as in Vienna. That these rates are relatively high and that the service is exceedingly poor, is fairly shown by the lack of development. The wages are even lower than in Vienna. They pay nothing for rights of way, and, as a significant example of the powers that the Government may exercise there, Mr. Bethell stated that it had licensed a private company (the Telephone Newspaper Company) to string its wires throughout the city, and to attach them to public and private buildings without any compensation whatever to the owners.

GERMANY.

Germany was next considered. Mr. Bethell said patents were never allowed for the telephone there, and the Government has monopolized the telephone business from the beginning, operating it as a part of the postal and telegraph business. There has been a very large development in Germany, especially in large cities which have been favored by the German rate policy. Until very recently they have had uniform rates throughout the Empire—that is, the same rate in a great city as in a small city. This policy was changed by law in 1899, to take effect April 1, 1900, and since the adoption of lower rates for the smaller places there has been some growth in them, but relatively the conditions have not changed much. There are 720 telephone centers in Germany, and Berlin alone has 25 per cent of the total stations. Nine large cities have 52.5 per cent of them, leaving 47.5 per cent to 711 other cities and towns. At the beginning of this year Berlin had 47,586 telephones, against 54,647 in New York, the population being approximately the same. The 1900 census figures give New York a little larger population than the latest available official figures give Berlin; but at the present time there is very little difference, if any, between the two cities in this respect.

A point that has been often overlooked when considering the Berlin service is that until Nov. 1, 1899, the service was rendered only from 7 o'clock in the morning until 10 o'clock in the evening. Since that date a night service has been rendered, but extra charges are imposed for calls made between 10 o'clock at night and 7 o'clock in the morning.

The lines are largely single wire, and a very large percentage of them are still overhead. The same policy with respect to wires has not been pursued in Berlin as in New York. That is to say, they have supplemented their overhead wires by underground wires because the former became so numerous that they could not very well add to their number; but they have not replaced in a general and comprehensive way the overhead system with an underground system.

In Berlin, too, the subscriber does a great deal of the operating; that is, he calls the central office with which he is connected, and then works his own way from that central office to the next, and so on, whereas in New York every call is so supervised that the subscriber has nothing to do but give his order, the operator taking care of it, until he is put into communication with the desired station.

The uniform rate holding throughout the Empire until April 1, 1900, was $37.50. At that time flat rates varying from $16 to $45, and minimum message rates from $20 to $30, were put in force. The rates now vary with the size of the town. The administration had many times reported to the Parliament that the Berlin system did not pay, various rate propositions were presented and considered, and finally in 1899 they enacted a law putting into force the rates mentioned. The Berlin rate was increased 20 per cent. Of the total number of subscribers throughout the Empire, 66.8 per cent (over two-thirds of them) were increased, 26.8 per cent were decreased (in the small towns), and 6.4 per cent were not changed. Thus it will be observed that the Parliament ratified the statements of the technical staff that the Berlin rate did not pay. Berlin is proverbially a cheap city. Wages, rents and almost all other items that enter into the cost of furnishing a telephone service range from two to four times as high in New York as in Berlin.

That the public patronage—the development—is less in Berlin than in New York shows that the service and the old rate were not more reasonable from the German standpoint than the New York service and rate from the standpoint of the New Yorker. Considering the character and amount of service and the purchasing power of money in the two places, the rates in New York are lower than in Berlin.

As to the responsibility for the inferior service so far as grounded circuit lines are concerned, the technical staff has frequently urged the adoption of the metallic circuit, but this was disapproved by the ministers who would not spend the money on what they considered an unprofitable industry. At last, in 1899, $1,000,000 was appropriated to begin the work of changing from the grounded circuit to the metallic circuit, and that work is now going on. A night service was not rendered until the question was considered by Parliament, and then only on the payment of extra charges. A revision of the rates was repeatedly urged. The unfairness of a uniform rate and the unprofitableness of the rate mentioned in great cities such as Berlin and Hamburg, were also frequently urged. These facts show a tardy response to the recommendations of the technical staff, of whose report Mr. Bethell read a portion.

BAVARIA.

As to Bavaria, Mr. Bethell said that it is, of course, a part of the German Empire, but its telephone system is operated separately by the Bavarian Telegraph Department. They have had the same rates and the same policy as to rates as in other parts of Germany. The general conditions are about the same. Munich has 8500 telephones. Nuremburg 3500. Seventy-one other centers have only 6000 or 7000

altogether. The technical staff has been a little more successful in having its recommendations adopted, and consequently the plant and the service in Munich are somewhat better than in Berlin.

HOLLAND.

Holland is particularly interesting because of municipal ownership in its two leading cities, Amsterdam and Rotterdam. A private company conducted the industry in these cities until 1890, when the municipalities obtained franchises from the State for 25 years. Viewed superficially and narrowly, it might be said that at Amsterdam the municipality on taking over the business reduced the rate, improved the service, in three years increased the numbr of stations 50 per cent, and made a profit. They must go further with a view to ascertaining the whole truth if possible.

The reduction in rate was insignificant in amount and, moreover, it was a mere shifting of taxation. The company's rate was $47.20 per year, the municipality's $36 at residences and business places for the exclusive use of the subscriber, and $46 for hotels, restaurants and places accessible to the public, plus in each case an installation charge of $10. Taking this last item into account, it will be seen that the reduction was on the whole very slight, and that in certain cases there was an actual increase. But there is another fact that must be taken into consideration. Under its franchise the company was required to pay the city 21 per cent of its gross receipts, which going into the communal treasury operated to lessen taxes in other directions. In 1894 the last full year of the company's concession the percentage amounted to $17,125.20. In 1898, notwithstanding the large increase in the number of subscribers, the communal treasury received from the telephone industry $20,000. The slight increase it may be safely stated was more than offset by the increase in the community's general expenses due to its telephone operations, to say nothing of the use of public buildings for supporting wires and fixtures for which no charges were made. Hence the communal treasury suffered by the change; in other words, whatever reduction was made benefited telephone subscribers at the expense of the general taxpayer. Therefore, the municipality is entitled to no credit for an alleged reduction of rate.

Touching the question of reasonableness, it is very significant that at The Hague the telephone industry is conducted by private enterprise at a rate of $24 a year. In other European cities where private companies operate there are larger systems and lower rates than in Amsterdam. The service is unquestionably better now than it was under the company's administration. But the present service is not so much a superior service as the former was an inferior service. Measured by other and fairer standards the present service loses its pre-eminence. What always happens under a limited franchise happened in Amsterdam. The telephone business in a way peculiar to itself calls for constant additions to capital account, and thus far in its history has called for constant and extraordinary outlays for reconstruction and substitutions. Hoping to undertake the business itself the municipality opposed an extension of the company's franchise and was successful. Having no assurance of life the company made no extensions or improvements. It did nothing to develop the business. There was no real growth, only 1700 stations in 1896. The municipality offered for the company's plant an amount equivalent to $47 per station. This being refused the municipality built a new plant, its investment being at the end of 1898 equivalent to $182.80 per station. With its new plant and with a skillful and enterprising manager an improvement in the service was inevitable, an improvement which was particularly noticeable to those who had suffered under the previous miserable condition due largely to the obstructive tactics of the municipality. But the Amsterdam service is by no means as efficient as that rendered by private companies in the Scandinavian countries, for example, or in this country. The feature that most condemns it is its insignificant scope, its entire inadequacy for so large a city.

This brings us to the question of development. Fifty per cent in three years sounds large, but in view of the starting point it means but little. Compared with that in cities of the same rank in this country or even in Europe, where private companies operate, the Amsterdam development is absolutely insignificant. At the beginning of this year Amsterdam, with a population of 513,000, had 4462 telephone stations. There are 64 American and European cities having a population of 200,000 or more. Arranged in the order of telephone development, Amsterdam stands fifty-eighth in the list. Among the cities of its class (from 500,000 to 1,000,000), it stands at the very bottom of the list with the exception of Budapest and Brussels(both having state ownership), and the two Russian cities of Moscow and Warsaw. Amsterdam and Boston are fairly comparable. They are about the same size—Boston a little bit larger. Both are seaports; both cities of commercial importance and activity. The statistics for Amsterdam, figure out 8.7 telephones per 1000 of population. Boston, with a population of 560,000, had 23,780 telephones at the first of the year, or 42.3 per 1000 of population; that is, 42.3 against 8.7 in favor of the American city. Comparing Amsterdam with Manchester, England: Population of Manchester, 543,902; telephones, 10,647, or per thousand of population, 19.6, against Amsterdam's 8.7, while Liverpool has over 20 against Amsterdam's 8.7.

Municipal boundaries and telephone exchange boundaries are not generally co-extensive. Around every great city there are suburban places of consequence, and usually the very center of their business and social lif is in the city. The municipality can serve only within its own area or else conduct a business beyond its borders where it has no jurisdiction. Amsterdam's activity is practicaly confined within the municipal limits, and as a result of that the development in the suburbs is practically nothing, while the development in the suburban towns and cities near Boston and New York is greater even, relatively speaking, than the development in the cities themselves. This limitation upon its activities, considering the peculiarities of the telephone business, is entitled to the greatest weight in considering the question of the advisibility of municipal ownership of telephones.

GREAT BRITAIN.

Mr. Bethell then gave the Commission some data as to Great Britain. There the telephone was early held to come under the Telegraph Act of 1869, which made the telegraph a government monopoly. The Postmaster General having thus the exclusive right to operate the telephone in Great Britain, and being unwilling or unprepared to directly exploit the new and doubtful enterprise, granted licenses to various private companies, limiting the operations of each to a specified area, and providing for the payment of a royalty to the Government of 10 per cent of the gross receipts. All of these licenses were made to expire in 1911. The restriction to specified areas by preventing interurban communication proved most unsatisfactory, and in 1884 other licenses which removed all restrictions and limitations as to the area in which the licensee company could operate, were granted. These new licenses were also made to expire in 1911. As a result, trunk wires were built between the several telephone centers, and trunk line traffic grew rapidly.

For a time the Post Office endeavored to establish competing systems. They feared the telephone would make inroads on their telegraph revenues, so they started a competition, but met with little or no success, notwithstanding that they were taking 10 per cent of their rival's earnings as a royalty. The next step in the history resulted in amalgamation. It became clear soon after the change in policy in 1884, already mentioned, that to get the best results, there must be uniformity of system, similarity of method, concentration of administration and management, and complete intercommunication between all subscribers. The outcome of this was an amalgamation and the formation in 1889 of the National Telephone Company, which extended its operations over the whole of Great Britain. One of the first results of this amalgamation, although none of the amalgamated companies had been in competition with another, was a reduction in rates practically to one-half of the former figures.

In 1898 there was a telephone inquiry by a select committee, presided over by the Secretary of the Treasury. In the report of this committee the main idea seems to be that during the remaining years of the company's license (it expires in 1911), the State should endeavor to break down the company's business through competition by itself or by municipalities. In 1899 the English Parliament voted 2,000,000 pounds to enable the Government to begin its competition in London, and empowered the Postmaster General to grant licenses to municipalities. There was, however, this element of fairness in the law. It was stipulated that whenever the Postmaster General licensed a competitor that thereby the National Company's license in the same area should be extended for a like time. The Post Office is now constructing its plant, and will probably begin rendering service in London before the end of this year. Licenses have been granted to some municipalities. Glasgow has already opened an exchange, but the movement has not yet gone far enough to be a subject of more than speculation.

The service generally was exceedingly bad, chiefly for reasons stated, and although the English rates are always said to be very

low by people comparing with the United States, there was just as much dissatisfaction there, and far more, in fact, than there has ever been over here.

The competition in London will not be on equal terms. The Post Office possesses statutory powers to run its wires, which the company does not possess. It can afford postal facilities to its subscribers, and deny them to the company's subscribers, and it takes 10 per cent of its rival's receipts. Under the same conditions, as already mentioned, the private company has in several cases outstripped the Government in its previous efforts to compete, and according to announcements made by officers of the company at a recent annual meeting it seems to be going forward cheerfully. So there is to be an interesting telephone war in London. There will be a waste of capital and great public inconvenience, but the final outcome no one can now foresee. These statements Mr. Bethell based on the various committee reports referred to, and on data taken from a recent communication to the London *Times*, and other expressions of unbiased opinion in the public prints.

Considering its handicaps, Mr. Bethell thought the development in Great Britain very creditable and generally speaking, far in excess of that attained on the continent under government or municipal ownership. On Jan. 1, 1901, London, with a population of 5,633,000, had 41,111 telephones; that is, 7 per 1000; New York, with a population of 2,050,000, had 54,647; per 1000, 26. Among European cities of its class, London's development is exceeded only by that of Berlin, and there they saw how the rate policy of the Government had developed the business at the expense of other imperial revenues. The rates, generally speaking, in England are flat. The Parliamentary committee in 1898 reported in favor of message rates. The London rates are: Direct line, business, $100; residence, $60 a year, with discounts for long-term contracts. In making a comparison between London and New York one must use the rates under one year contracts in both places. The payments are required annually in advance in London; in New York monthly in advance. The National Company carries a large fund as rentals paid in advance; its statement at the close of last year showed $3,840,000 in the fund. The amount for London was not stated. Doubtless it was a considerable sum. The London *average rate* is, conservatively, a figure approximating $72. The average rate in New York is $85. The difference in the cost of rendering the service in the one item of wages, the New York wages exceeding London's on an average by 100 per cent, is more than enough to account for the difference between these average rates. Comparing what the average subscriber gets in the two cases, one might suppose that where there is a flat rate—an unlimited user—the average subscriber would get more service than where the message rate is applied; that, therefore, in London for $72 the average man gets more than he does in New York for $85. Unquestionably, imposing a charge on each message reduces the number of messages sent. That is human nature, but in the main it is the frivolous conversations that are eliminated—the office-boy's discussions of last night's episodes and the making of his appointments for to-morrow, and the like. Still some proper traffic is suppressed, because of the message rate, just as the consumption of water, gas or electricity is curtailed by the placing of meters. As between two places, one restricted and the other not, the restriction in the one place may be offset by a superiority in the scope and efficiency of its service. In New York, for instance, most important transactions of all sorts are carried on by telephone without any hesitation whatever. The service is so permanent, reliable and quick that it is very generally relied on. The London service is not so generally relied on, because of its inferiority due largely to the municipality's refusal to permit the company to put in such a plant as is absolutely necessary to render efficient service, and also because their system is smaller than that in New York, where there are 26 and in London only 7 telephones per 1000 of population. The number of talks per station is just as great in New York as in London, notwithstanding that in New York they charge for each talk, while in London the charge is the same whether the talks are many or few.

On the question of wages Mr. Forbes, president of the National Telephone Company, of England, testified before the select committee of the House of Commons, in 1895, that the wages of the company's operators varied from 5 shillings (for under studies) up to 17 shillings per week; lady superintendents, about 2 guineas per week; wiremen, 6 shillings a day. The testimony taken at the Glasgow inquiry in 1897 showed the average pay per week for the National Telephone Company's operators in that city to be 9s. 4d. The London wages may have been increased since 1895, but considering the ruling rates then and now for all classes of labor in London, it is safe to say that the increase, if any, cannot have been great. These rates of pay with a reasonable allowance for increases compared with those already mentioned for New York show that the statement that New York wages average double those in London is very conservative. Considering the extent to which labor enters into the service, and the difference in wages, as well as the differences in rents, transportation costs, etc., there should be a greater difference perhaps between the New York and London rates in favor of New York, but in fairness, London is entitled to a consideration of the facts that it pays a royalty of 10 per cent to the Government, and that the cost of the service is largely increased by the obstructive policy of the municipal government. Much that in New York they were enabled out of earnings to pay to labor in the way of wages goes in London to the government in the way of royalties, or was wasted through municipal interference.

DENMARK, SWEDEN AND NORWAY.

Turning to Sweden and Norway, Mr. Bethell said that in the Scandinavian cities they had a demonstration of what can be accomplished even on European soil by private enterprise, nothwithstanding the embarrassments of governmental and municipal interference and opposition. The situation in these cities has been greatly misunderstood by those who have not studied it very carefully. Speaking first of Copenhagen, the industry there is conducted by a private company. Copenhagen is one of the best telephoned cities in Europe. Its population is 312,859. At the beginning of this year there were 15,311 telephones, or 49 per 1000. San Francisco, with a population of 342,782, had at the same time 21,324 telephones, or 62 per 1000. The Copenhagen rates are: At residences, $27; at business places, from $32.40 to $48.60 per year; message rates, $13 per year up. Wages are exceedingly small. Skilled operators are paid from $2 to a little over $3 per week; linemen, etc., about $5.70 per week.

Until recently the lines were overhead and the system was worked on the single wire plan, but fair progress has been made in substituting metallic circuits underground. The central office equipment is somewhat out of date, but a new building and new equipments are being provided. Notwithstanding these excellent conditions obtained under private ownership, the Danish Government in 1898 assumed control of the business. It, however, issued a license to the company that had built up the business, for 20 years, reserving a power of general control and of fixing the rates every five years. In 1899 the Government fixed the rates already mentioned, which are slightly lower than those which obtained prior to that time. On the other hand, the Government relieved the company of various burdens previously borne, in the way of rights of way charges, etc., gave it protection from users of high tension electric currents, and in other ways bestowed upon it advantages that usually accrue to a European state.

By comparing these facts with those stated as to other European places, it was seen that the best conditions thus far commented on exist at Copenhagen, where until very recently the industry was left to private enterprise with but little interference. Moreover, considring the relative purchasing power of money, in the cities of even rank in this country and in Copenhagen, the rates in the Danish city are relatively as high as those in the American cities.

In Sweden the Government has no monopoly by law of either telegraphs or telephones, but has the advantage of an exclusive right of way for telegraph and telephone lines over the State's highways, and on crown property. Except in Stockholm, the industry is now conducted by the State exclusively. Stockholm has the largest development among cities of its class (of from 200,000 to 500,000 population) in Europe or America, except possibly San Francisco. In presenting American figures for cities having two systems in operation, Mr. Bethell used only the figures for one system, believing that any other figures—which would necessarily be duplicated to a large extent—would be unfair and misleading. He did the same in presenting the figures for Stockholm. On Jan. 1, 1901, with a population of 320,000 the private company operating there had 22,000 telephones, or over 69 per 1000. San Francisco has been making such rapid strides that now it is perhaps ahead of Stockholm. But at the first of the year Stockholm was in the lead.

In Stockholm there is a public system and a private system, which have been in active competition since 1890. The business is chiefly in the hands of the private company, its stations numbering at least two to the state's one. Usually the development in Stockholm is attributed to the Government, and generally popular writers, by ignor-

ing the existence of the private company and by referring only to the State, lead the public far from the truth. On visiting Stockholm one is impressed by the beauty of the city, the substantial character of its buildings, the activity of its people, and, above all, by the cheapness of things. On this matter of cheapness, Mr. Bethell quoted at some length the present American Minister at Stockholm, Mr. W. W. Thomas, who has spent the greater part of 40 years in Sweden representing our Government in various capacities, and has written a book on Sweden and the Swedes.

In the telephone company's service skilled operators are paid from $1.95 to $2.92 per week; linemen and mechanics, about $6, and foremen about $8.50 per week. The company has in its entire territory in and around Stockholm 27,247 stations, and 573 employes, i. e., one employe for 47 stations. In New York the figures work out one employe for 17 stations. These figures are very significant.

In view of various facts presented showing the conditions of living and the cheapness of things in general, one should expect under normal conditions to find telephone rates that to us would appear to be very low. But the conditions are not normal. The bitter competition between the private company and the Government has created conditions which make it quite unsafe to take any rates that we may find in Stockholm as a criterion of what should be expected elsewhere even were it possible to make due allowances for any differences that might affect the relative costs of rendering the service. On this point Mr. Bethell quoted from the official report of the director of the municipal telephone industry at Amsterdam, made in September, 1898, after a thorough investigation of the subject on the ground, and from documents before a select committee of the House of Commons, showing that the Stockholm rates were too low even for cheap Sweden.

STOCKHOLM.

There are now 7000 or more subscribers who are required to take both telephones, and the number of intercommunications amounted last year, according to the Allmanna Co.'s report, to 1,099,837. The combined rates and the extra charges, to say nothing of the great annoyance and vexation incident to the duplication of instruments, to a very large percentage of telephone users in Stockholm amount to a very considerable sum. The rates therefore under these conditions are not at all what at first glance they seem to be. Under competition, therefore, Mr. Bethell contended, as seen in this Stockholm case, there is a waste of capital and energy, the public is annoyed, in many cases overcharged, and, in a way, badly served because of a fight in which it has no interest. Thus far the company has had the best of the fight so far as victory may be measured by the amount of public patronage, having now, as already stated, about twice as many stations as the Government. According to the various data quoted by Mr. Bethell, while the Allmanna rate ranged from $27 to $10, yet in order to get full and effective service, the subscriber had absolutely to connect themselves with both the "Rikstelefon" and the Allmanna Company, and then pay at least $40.50 per year, with a minimum of $27 as entrance fee. Further, every call interchanged between the two systems cost the subscriber 2.7 cents.

GENERAL CONCLUSIONS.

Summing up this part of his evidence, Mr. Bethell said: "I have now gone over the whole of Europe touching upon the conditions in every country where there is any development worth noting. I have dealt only with the conditions that are most favorable to Europe, ignoring places where there is practically no development. Were these taken into account, American pre-eminence would only be made more prominent. We have observed that the poorest conditions obtain under Government and municipal ownership; that better conditions obtain under private ownership with Government control, and that the best conditions obtain under private ownership where there is the least Government and municipal interference. In not one of the cases where there is Govrnment or municipal ownership have we found in combination adequate facilities, efficient service, reasonable rates, and a self-sustaining system. Of cities having a population of 200,000 or more in America there are 20, in Europe 44. In the American group there were at the first of this year 21 telephones per 1000 of population; in the European group 13; almost two to one in favor of the American group. Among cities of 1,000,000 or more, New York stands at the top with twice as many telephones per capita as any city in its class except Berlin, and it is far ahead of Berlin. Among cities from 500,000 to 1,000,000 Boston stands at the top, with more than twice as many as any European city except Hamburg, and almost twice as many as Hamburg. It will be remembered that at Berlin and Hamburg the growth has been accelerated by means that have stifled growth in other parts of Germany, or that have been a charge upon other than telephone revenues. Among cities from 200,000 to 500,000 Stockholm stands at the top, but in a fair comparison, San Francisco is unquestionably entitled to the honor. In the smaller European cities and towns the development becomes insignificant when compared to that in American cities and towns of equal rank. President Hadley has said: 'There is one respect in which England and America are like one another, but sharply different from France, Germany or other European countries. It is in the way in which people in general are disposed to regard governmental interference. The English and American maxim is that whatever can be done without government should be thus done. The continental principle is that whatever can be done by government should be. It has become a commonplace saying that our Anglo-American idea of liberty is not developed in continental Europe. When a Frenchman speaks of liberty, it is not so much freedom from interference with his own movements that he seeks as the right and power to interfere with other people's movements. What he really wants is political power. A party may call itself Liberal or Republican, but when it gets into power it governs about as strictly as its predecessor. Sometimes there is a monarchy, sometimes a democracy, but there is always a bureaucracy—a government by office-holders.' England seems to have forgotten the maxim temporarily. But loss of trade and lack of progress will cause her to recall it in due time. Already there is a strong movement in that direction. Recognizing this difference in the popular idea of liberty, and observing that the telephone development in the United States under private enterprise is far ahead of that in Europe under government and municipal ownership, we may safely conclude that the best possible results will be obtained in this country by leaving the industry to private enterprise."

Detailed Figures of Foreign Trade.

The detailed figures of the foreign commerce of the United States in the year ended June 30, 1901, were completed by the Treasury Bureau of Statistics last week. They show total imports, $822,673,016; total exports, $1,487,755,557; exports of domestic products, $1,460,453,809.

The exports of domestic merchandise by great classes were as follows:

	1900.	1901.
Products of agriculture..	$835,858,123	$944,059,568
Products of manufacture.	433,851,756	410,509,173
Products of mining.....	37,843,742	39,267,647
Products of the forest....	52,218,112	54,312,830
Products of the fisheries..	6,326,620	7,743,313
Miscellaneous	4,665,218	4,561,278

Each of these great classes, except manufactures, shows a marked increase over last year. The apparent decrease in manufactures, which amounts to $23,342,583, is due chiefly to the absence of figures showing exports to Hawaii and Porto Rico, which are estimated at about $25,000,000 for the year, and largely consisted of manufactures.

In two important articles of manufacture, however, the exports of 1901 fall below those of 1900. The total exports of copper in 1901 were 252,769,328 lbs., valued at $41,260,376, against 333,340,725 lbs., valued at $55,772,166, in 1900. This decrease was chiefly due to a reduction in demand for copper in Europe.

The principal increases in exports are: To the United Kingdom, $97,000,000; British North America, $10,000,000; British Africa, $5,000,000; Germany, $3,724,363; Mexico, $1,500,389; Chile, $2,007,161; Peru, $1,464,459; Porto Rico, $2,601,025, and the Philippine Islands, $1,388, 615.

By far the largest increase was to the United Kingdom, to which the exports were $631,268,263 in 1901, against $533,819,535 in 1900, the total increase being nearly $100,000,000, of which over $50,000,000 was in cotton, about $15,000,000 in breadstuffs, and about $10,000,000 in provisions. The total exports to British territory were valued at $819,551,392, or 55.8 per cent of the total exports of the year.

The total imports of the year were $27,268,168 less than those of 1900 and $22,243,180 less than those of 1891, 10 years earlier. The total exports were $93,972,475 in excess of those of 1900, and $603,274,747 in excess of those of 1891, 10 years earlier. The excess of exports over imports was $120,540,643 greater than that of 1900 and $625,517,927 greater than that of 1891.

The Electric Elevator in the Washington Monument.

By C. M. Lewis.

THE tall white shaft, the "Sentinel of the Potomac," is again in commission, after having been closed several months for the removal of the old and obsolete steam-driven elevator and the installation of an electric elevator. Once more patriotic Americans can ascend the shaft and look out over the city, the hills of Maryland and Virginia, as 2,000,000 others have done since the monument was first opened to the public. The contract for the power plant, the motor and elevator machinery and car, was not let until spirited bidding had been indulged in, and the electrical engineers representing the interests of the Government were fully satisfied that the electric light and power plant, and elevator would meet the exacting conditions imposed.

Before taking up the description of the elevator machinery a brief description of the very excellent light and power plant is in order. The monument stands in the center of a circle about 1500 ft. in diameter, and a drive surrounds it, with other drives and walks leading from the driveway to the foot of the shaft. A few feet beyond this circular roadway, to the west of the Monument, was a small power house that formerly supplied steam to the engine in the underground engine-room on the west of the base of the shaft. This little stone building was enlarged to meet the requirements for properly housing the electric light and power plant. The boilers being already in place it was only necessary to install the engine and generator and switchboard and run the copper cables to the motor and light switchboards at the Monument. The enlarged power house has room for another generator similar to the one installed, which is an engine type, girder frame, 240-volt direct-current generator of the Crocker-Wheeler Company, which has a normal capacity of 50 kilowatts at 275 r. p. m. It is, as shown, directly connected to a duplex compound engine, built by the American Engine Company.

This engine is of the marine tandem type, in which the high-pressure cylinder is superimposed over the low-pressure cylinder. The results claimed are greater economy of floor space and a neater and more attractive looking engine. The cylinder dimensions are 9½ and 15 by 11. While the city water mains have been tapped by a 1600-ft. supply main, leading to the power house, the engines work non-condensing at 75 lbs. ihp. The builders guaranteed the efficiency of 27 lbs. of steam per ihp. per hour. In the sub-cellar there was built of concrete a very solid and substantial pier, 11½ ft. high, on

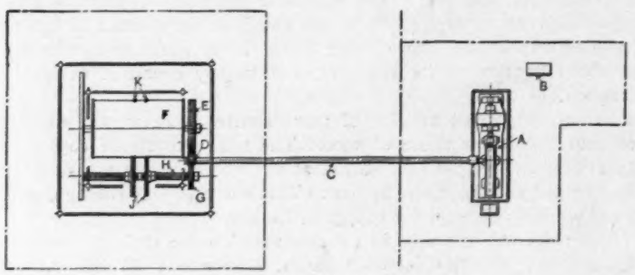


FIG. 1.—OUTLINE PLAN OF PLANT.

which the engine and generator were set. From the generator to the switchboard the current is carried by rubber-covered leaded cables in iron conduits. The cables are of 300,000 cm. area, and are suspended from the floor beams of the engine-room. The steam pipes leading from the boilers to the engine are of wrought iron, with steel flanges, and are neatly encased in magnesia covering. The switchboard consists of two panels of 2-inch pink Tennessee marble, 5 ft. by 2½ ft., mounted on miniature monuments of the same material, with an additional frame of angle iron. These little highly polished monuments, it is said, are made on an exact reduced scale of the Washington Monument. There is a space 2 ft. wide between the back of the switchboard and the wall. The generator panel is equipped with Weston copper finished round pattern ammeter and voltmeter, 300-ampere Cutter I. T. E. circuit breaker; single-pole, double-throw field regulator, and a 300-ampere double-pole, double-throw switch, arranged to take current from city service in case of necessity. On the feeder panels are four 150-ampere double-pole, single-throw switches, and a Thomson recording wattmeter. Provision has been made on the switchboard panels for installing hereafter three more Thomson recording wattmeters. The conducting cables from the power and light switchboard to the motor and light switchboards at the monument were placed in position by the Government. These two separate circuits are lead through the old brick line steam pipe tunnel from the power house to the monument. The 250,000 cm and 100,000 cm lead and rubber-covered cables, the former for power and the latter for lighting, are suspended from the sides of the tunnel on Fletcher porcelain iron-banded insulator cleats, secured to 2-inch by 4-inch battens of Georgia pine. About 500 persons visit the monument each week day, and perhaps 100 of them on an average climb the long stairway. The tremendous advantages of the new system over the old may be briefly summed up as follows: With the same boilers there is now a greater power actually available, with the saving of nearly three-quarters of a ton of coal per day. The elevator now makes the trip in five minutes against ten by the old method, and at the same time carries a larger load. The change from steam to electric power has not made it necessary to increase the number of monument employes.

The new electric elevator plant which was installed by the Marine Engine & Machine Company, replaces the original steam ele-

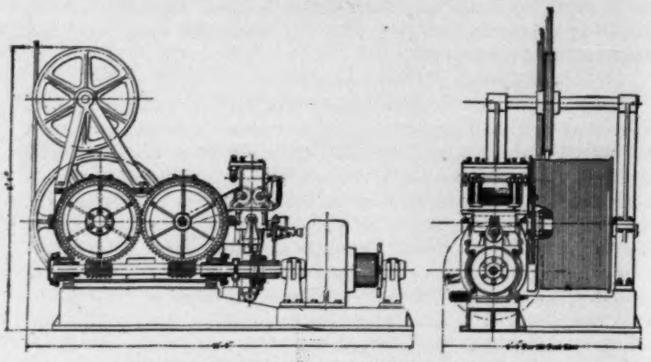


FIG. 2.—SIDE AND END ELEVATIONS OF ELEVATOR.

vator installed by Otis Brothers & Co., at the time the Monument was built to its present height of 555 ft. The old steam elevator had performed its daily work for 15 years without a single accident or any material repairs, and all its parts were in excellent condition when removed. It was a model of elevator engineering in its day, but its slow speed of about 50 ft. per minute and the great loss of transmission of the steam power to the hoisting engine from the boilers 800 ft. distant, impelled the Government to substitute a modern electric plant, which would increase the car speed as well as the efficiency of the whole plant from the coal pile to the actual work done at the car. The original elevator car with its safety devices, etc., weighed 6500 lbs., and when loaded to its normal capacity of 6000 lbs., the net load on the hoisting drum was 12,500 lbs.

The specifications issued by the government engineers for the new electric elevator called for the introduction of a counterweight system to overbalance the effect on the hoisting drum, of the car and a part of its load. The weight of the new car, together with its safety device, cage, etc., is 5670 lbs., and the weight of the drum counterbalance installed is 8040 lbs., leaving a net overbalance on the hoisting drum of 2370 lbs. when the car is empty. With the maximum load of 6000 lbs. in the car, the net load on the hoisting drum to be lifted by the machine is therefore 3630 lbs. at 100 f. p. m., equivalent to 11 horse-power in gravity work as compared with 18.9 horse-power in gravity work for the old car. The net result of the two systems compared is the same live load lifted by the new elevator at double the car speed, with 58 per cent of the energy required at the hoisting drum that was required by the old elevator to lift the same live load, viz., 6000 lbs. at 50 f. p. m., one-half of the speed of the new elevator. The consequent saving in power, together with the increased efficiency of the electric over the steam hoisting machine, enabled the government engineers to double the speed of the elevator with the same load and have power to spare to light the Monument and grounds.

The hoisting machine drives the 72-inch winding drum through the medium of a 6-inch pinion shaft about 30 ft. long, extending through a tunnel under the base of the Monument to the old engine-room. On the Monument end of this shaft there are two pinions of 13 teeth, 3-inch circular pitch by 7-inch face each, teeth staggered.

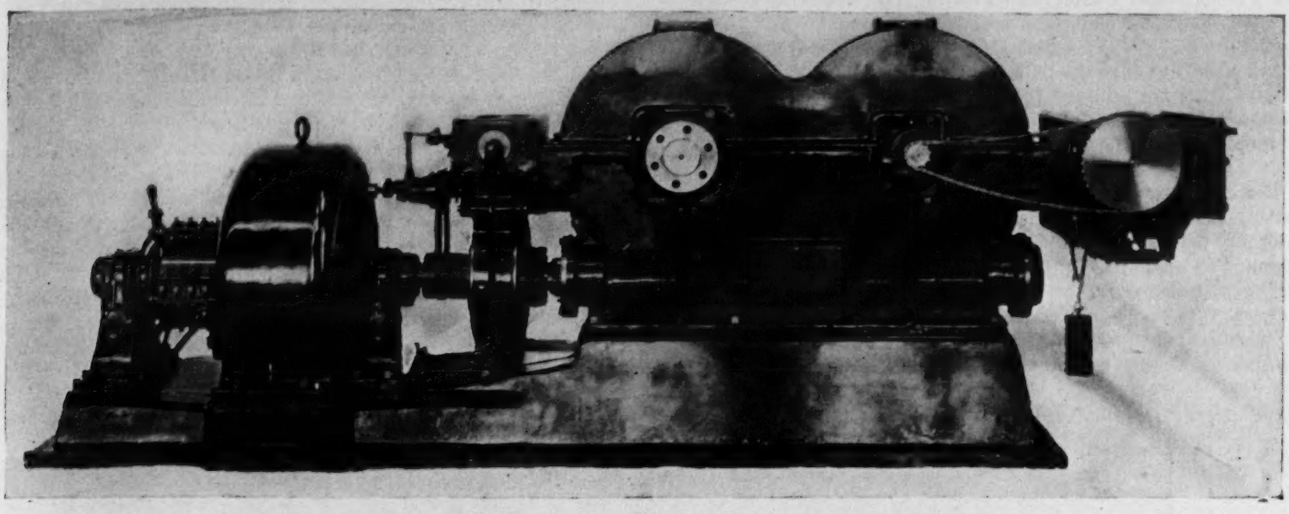


FIG. 3.—MOTOR AND ELEVATOR MECHANISM.

These pinions mesh into similar gears that are bolted to one end of the winding drum and have 75 teeth.

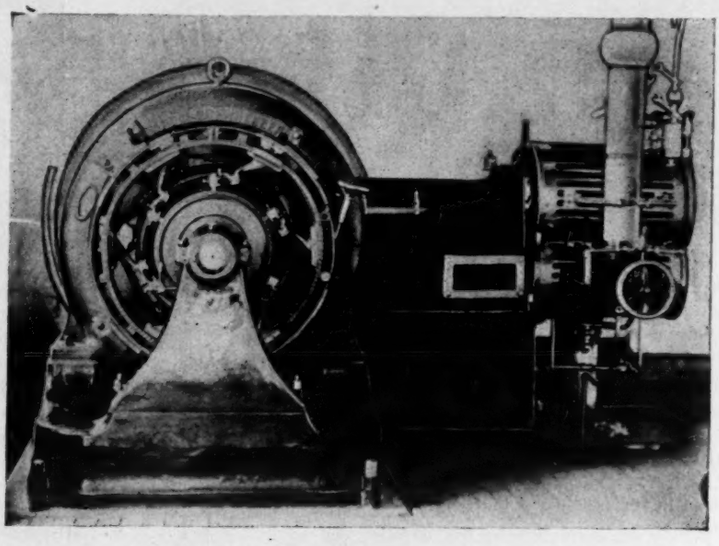
An outline plan is shown of the location of the hoisting machine at the base of the Monument, in which *A* is the hoisting machine, *B* the control, *C* the 6-inch shaft, one end of which is coupled direct to one of the spiral gears and carries on the other end pinion *D* that drives the spur gear *E* that is bolted to the drum *F*. The pinion *D* also drives the spur gear *G* that is keyed to the idler screw shaft *H*. On this shaft are carried the idler sheaves *J*. These sheaves revolve on right and left-hand nuts, respectively. These nuts are held from turning by guide bars that are guided on a T-rail below the screw. The sheaves are, therefore, forced apart and drawn together as the spur gear *G* is driven in one direction or another by the pinion *D*. The drum *F*, on which the two pairs of 1½-inch diameter ropes are wound, is grooved right hand on one-half and left hand on the other half, and the spur gear *G* and pitch of the screw *H* is designed to cause the idler sheaves *J* to travel so as to follow the lead of the ropes from the drum *F*. The ropes that pass under the sheaves *J* lead to the counterweight. The other pair of ropes *K* lead to the car.

The broken lines indicate the outline of the base of the Monument and the engine-room, the floor of the engine-room being about 12-ft. below the level of the base of the Monument and the shaft *C* passing through a tunnel between the engine-room and the hoisting drum. This arrangement was obviously necessary, as there was no room inside of the base of the Monument to place the hoisting machine. It had therefore to be located outside, as shown, so as not to disturb the foundation. The drum is 72 inches in diameter, 9 ft. long, and is grooved right and left for two 1½-inch ropes. All of this apparatus being in good condition and so located as to make it impracticable to remove and replace by any other mechanism, had to be retained and the new electric hoisting machine adapted to drive this drum at 5.3 r. p. m. to give a car speed of 100 f. p. m., which speed was considered by the government engineers to be as fast as the existing conditions at the Monument would permit.

The gear reduction of 13 to 75 teeth between the pinion shaft and winding drum, required the pinion shaft to run at 30.58 r. p. m., the pinion shaft to be driven by the new electric hoisting machine.

The Marine Engine & Machine Company were the only bidders who offered to couple this pinion shaft direct to their worm-gear shaft, all other bidders specifying additional spur gears for a further reduction to suit the requirements of their particular machines. The tandem spiral gears specified by this company were considered to be superior to the straight cut or to the combination of worm and spur gears.

The hoisting machine proper is of the tandem worm gear type with right and left hand worms, forged on the worm shaft, driving spiral gears which mesh together. The pitch of gears used in this particular machine and the absence of spur gears to connect the worm wheels, result in a machine of high efficiency. The worm shaft is direct connected to a 35-hp Crocker-Wheeler multipolar motor, having a special shunt field winding. The normal speed of the motor is



FIGS. 4 AND 5.—VIEWS IN ELEVATOR AND ENGINE ROOMS.

628 r. p. m., which gives a car speed of 100 f. p. m. Field variation will, however, give speeds both above and below the normal if required.

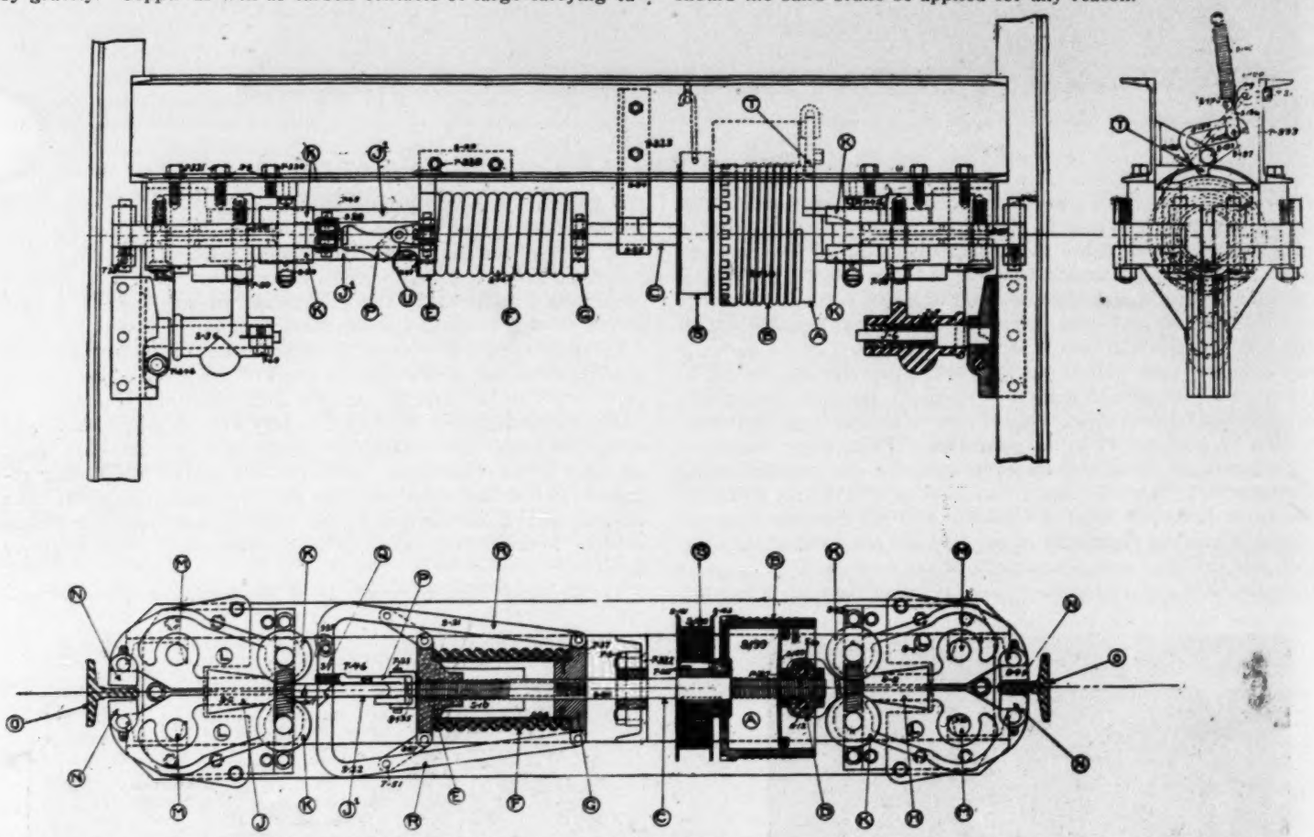
The brake consists of a pulley keyed on the worm shaft and two cast-steel brake levers holding wood shoes against the pulley. The brake is applied by a compression spring and released by an electromagnet. The upper and lower limit device is an improved type driven by the drum shaft, and utilizing the well-known "traveling nut" on a screw shaft to open the limit switches at both limits of car travel. The switches are returned to their normal positions by means of a weight instead of a spring. The centrifugal governor, driven by the worm shaft, operates at a determined speed, to cut off current supply to motor and apply brake.

The controller consists of three essential parts, viz., the two reversing switches shown on the lower panel and the resistance regulator on the upper panel. The panels are of Tennessee marble mounted on an angle iron frame.

The reversing switches are of the usual type, consisting of a solenoid core to which are attached the copper contact plates. The switches are closed by the core being drawn into the coil, and opened by gravity. Copper as well as carbon contacts of large carrying capacity are provided, all contacts being independently movable. All arcing takes place on carbon contacts, which "make" first and "break" last.

The resistance regulator consists of a contact arm traveling over the contact plates to which the resistance grids are connected. The contact arm is connected by means of the rack and gear to the core of the solenoid. At the right of the gear is a small electro-mechanical brake which will hold the contact arm in any position as long as desired. The coils of the regulator and brake magnet are connected in series when it is desired to raise the contact arm and "cut out" the resistance, thereby accelerating the motor. When it is desired to introduce the resistance into the motor circuit, the brake coil only is energized, releasing the brake and allowing the arm and core to return by gravity to the position of all resistance in circuit. By manipulation of the operator's switch the arm can be raised or lowered step by step as desired, giving variable car speeds from zero to maximum. Suitable switches, operated by the rack at both limits of travel, are provided to open the circuit of the regulator and brake coils and also to close the circuit to the "field relay" after all the starting resistance is cut out. This arrangement allows the operator to "weaken" the motor field, if he desires to increase the car speed, only under proper conditions. The "field relay" is shown in the upper left hand corner of the panel. The small relay shown in the upper right-hand corner works in conjunction with the reversing switches to introduce resistance in series with their respective coils after the switches are closed and also to automatically return the resistance regulator to its normal starting position.

The controller is also provided with an "under" and "overload" I. T. E. circuit breaker. The circuit of the underload coil runs to the elevator car where a suitable switch is provided for the operator to open this circuit if desired. This switch also opens the machine brake circuit. The operating device consists of a switch with suitable contacts for operating the reversing switches on the controller and to control the movements of the resistance regulator contact arm, and the field relay. A "slack cable switch" is also provided which operates to open the reversing switches and the I. T. E. circuit breaker, thereby stopping the motor. A switch, operated by the band brake on the winding drum and connected in series with the slack cable switch, will produce the same result at the controller, should the band brake be applied for any reason.



FIGS. 6, 7 AND 8.—DIAGRAM OF ELEVATOR "SAFETY," ETC.

The counterbalance weighs 8040 lbs. and is driven by two 1½-inch iron ropes attached to the opposite side of the drum from the hoisting ropes. The counterweight ropes lead up over a new sheave 58 inches in diameter, and thence down to and under the two traveling idler sheaves which lead the ropes to the under side of the drum. These idler sheaves are 49 inches in diameter each, and run on a threaded shaft 8¾ inches outside diameter, and 11 ft. 3½ inches between bearings. The thread is single, 13-16-inch pitch. The shaft is driven by a gear with 35 teeth, meshing into the drum pinion. The idlers revolve on a traveling nut, thereby following the exact lead of the ropes from the drum. The rope grooves on the drum had to be extended by hand cutting, to get a full turn for each counterweight rope. Counterweight ropes were not considered when the drum was originally designed, and there was just room enough to extend the grooves to the desired point. The idlers are of the largest diameter that could be installed in the space obtainable for them, and the cramped conditions existing about the winding drum, which is directly under the elevator hoistway, rendered the work of installing the necessary apparatus very difficult. New steel T-

rails and supports for them were installed, to guide the counterbalance which is 54 inches between rails and 15 ft. 6 inches over all.

The rope system is balanced by a chain counterbalance, weighing 3550 lbs., one end of the chain being attached to the car and the other to the counterweight. The effect of this load on the steel structure of the Monument had to be calculated and the supporting beams for the new counterweight sheave arranged in such a manner that the load would be distributed to the best advantage. The designs submitted by the M. E. & M. Co. were considered to present the most satisfactory solution of the problem, and the work was installed, as shown on the proposed layout submitted with their bid.

The car frame and platform is of standard corner post steel construction, with a platform 8 ft. 2 inches by 9 ft. 4 inches. The car enclosure is of ornamental grill work, finished in electro-bronze and lighted by a 6-light electrolier. The safety device was required to operate on smooth steel rails, which made it necessary to remove the cast-iron racks used in connection with the old safety device, and to install in their place standard steel T-rails. Views are shown in diagram of the safety furnished by the Marine Engine & Machine Company. Attached to the steel channels underneath the elevator car, the jaws *N* in the plan are shown set clear of the steel T guide rails. These jaws are pivoted to the outer ends of the two pairs of jaw levers *L*, which are pivoted on pins *M*. On the inner end of each of these jaws are a pair of rolls *K*, and between each pair of rolls are a pair of wedges *H* and *J*. The pair of wedges *H*, at the right hand of the safety, are bolted to a bronze nut *D* mounted on the screw shaft *C*. The wedge *J* at the left of the safety form the ends of rods *J J* that passes through the bronze nut *E* at the left hand end of the screw shaft *C* and are tapped into the spring head *G* at the right-hand end of the main spring *F*. Power to draw these two pairs of wedges together force the rolls apart and force the jaws against the guide rails, is applied as follows:

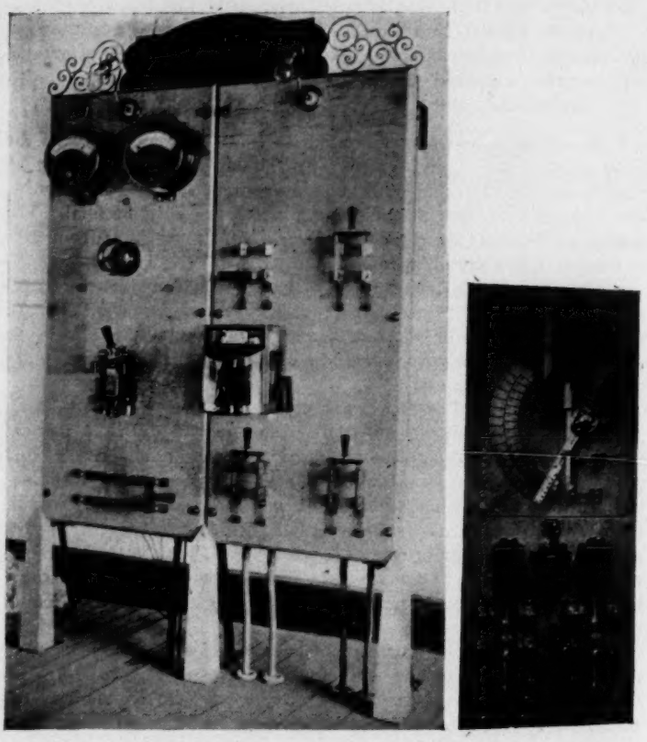
The centrifugal governor is located at the top of the hoistway, an endless wire rope passes over its driving sheave, down under a tension sheave at the bottom of the hoistway, and a branch wire rope *B* spliced into it leads to the dram *A* that is shown fastened to the screw shaft *C*.

The action of the safety is as follows: The centrifugal governor operating instantly the normal speed is exceeded, grips the endless rope and stops it, the continued travel of the car causes the drum *A* on the safety screw *C* to revolve, as the outer end of the rope *B* that is wound around it and fastened to the endless governor rope is now stopped. The safety screw *C* has now commenced to revolve, and its action upon the wedges through the medium of the main spring *F* is much more simple and effective in its operation than can well be described briefly. This screw *C* has a right-hand thread on its right-hand end, and a left-hand thread on its left-hand end, thus drawing the two nuts *E* and *D* together as it is revolved in the proper direction to do so. As it advances through the left-hand nut *E* it forces a push bar *P* against a latch *Q* that locks the toggles *R* together that hold the main spring *F* compressed. Upon the release of this latch *Q* the main spring *F* extends, forcing the left-hand pair of wedges *J* that are secured to the right-hand spring head *G*, towards the right, and forcing the right-hand wedges *H* that are secured to the left-hand spring head *E* by means of the right-hand nut *D*, screw *C*, and left-hand nut *E*, towards the left. In other words, this main spring *F* being unlatched, extends and draws the two pairs of wedges together, thus bringing the jaws *N* instantly in contact with the T guide rails *O*, with sufficient pressure to check the speed of, but not enough to stop the car. All this occurs before the car has traveled one foot after its normal speed has been exceeded. The further motion of the car continues to revolve the drum *A* and screw *C*, and draw the right and left-hand nuts together, and now occurs the action that is altogether novel in elevator safeties. The jaws *N* have instantly gripped the rails *O* as in all spring safeties, and the main spring *F* is extended to its weakest working length, the continued revolutions of the screw *C* now drawing the two nuts together compress the main spring *F* until sufficient pressure is applied to the rails to stop the car, thus bringing the lightest or the heaviest load to a perfectly gradual and easy stop, and with practically unlimited power.

Should there be any doubt as to the reliability of the main spring *F* this safety would operate without its action, as other types of safeties do, by transmitting the action of the screw *C* positively to the wedges by means of the steel tube that is inside of the main spring *F*, and acts as a stop or distance piece between the two spring heads. The release of this safety is effected simply by pulling on the governor rope from any part of the hoistway or from the car, and the flat spiral spring *S* winds up the screw *C* and automatically relatches all working parts, ready for the next operation.

The object of this safety is to overcome what are regarded as radical faults in other types of elevator car safeties. In this safety, the spring used checks the speed of the car instantly, and finally stops the car by being gradually compressed up to the point of its maximum resistance, stopping all loads at any speed with practically unlimited power and perfect safety and comfort to the passengers. This safety can be operated from the car by a simple device that grips that part of the endless governor rope that travels in the opposite direction to the car. It can also be made to stop the car when going either up or down, is so desired.

Notwithstanding the engineering difficulties experienced in surveying the plant, designing the apparatus, estimating the friction losses in the old drum gears, shafts, sheaves and ropes and the danger attending the installation of the work, the plant was completed without an accident or error. The guaranteed efficiency of the whole elevator system was 40 per cent at maximum load, 6000 lbs. at 100 f. p. m. The test made by the government engineers under the above conditions showed an efficiency of 41.09 per cent from the electrical energy delivered to the controller, to the actual work done at the car in lifting the load. In consideration of the friction losses in the heavy spur gearing at the drum, the long 6-inch pinoin shaft, the two 48-inch idler sheaves mounted on an 8¾-inch screw shaft



FIGS. 9 AND 10.—SWITCHBOARD AND ELEVATOR SWITCHES, ETC.

driven by the drum gears, and the loss due to driving two pairs of 1½ inches in diameter iron ropes over their idler and overhead sheaves, this efficiency of 41.09 per cent is high as compared with ordinary electric elevator installations. The efficiency of the elevator system as a whole is no doubt due to the high efficiency of the spiral worm gears in the hoisting machine which have the usually steep angle of 15½ degs.

The entire work at the Monument, including the new power plant, was installed under the direction of Colonel Theodore A. Bingham, Corps of Engineers, U. S. A., who represented the Government. The design of the elevator system as installed by the Marine Engine & Machine Company is the work of Mr. Charles R. Pratt, mechanical engineer of the company, and Mr. B. N. Jones, who designed the controlling system. Mr. Jones was charged with the supervision of the construction work, and he was ably assisted by Mr. C. H. Plunkett, constructing engineer in charge of the installation work for the company.

Regulations for the First Long Distance International Automobile Test in America.

We give below, as of more than usual interest and in response to many inquiries, the rules and regulations of the Automobile Club of America for the 500-mile, New York-Buffalo endurance test, to occur during the week of Sept. 9-15. A cable message received by the club on July 30 announces the entry of the famous French automobilists, Charron, with a Panhard, and Fournier, with a Mors. It will be remembered that Fournier has just won the great Paris-Berlin race:

The Automobile Club of America, recognizing the growing interest of the general public in the new industry, and desiring to promote and encourage this interest, has decided to hold a 500-mile endurance contest during the week beginning Monday morning, Sept. 9, 1901, which contest will consist of a run starting from the clubhouse, Fifth Avenue and Fifty-eighth Street, in the city of New York, and terminating at the city of Buffalo, Saturday afternoon, Sept. 15.

The route will be over roads good, bad and indifferent, representing on the whole, however, about the average condition of the country roads in the United States.

In this connection it is particularly desired to emphasize two facts: First, that this is not to be considered a speed contest; second, that it is to be an endurance contest. The principal thought of the club is to afford opportunity for the various types of motor carriages to demonstrate their reliability and enduring qualities in a practical road contest.

The undersigned committee has been charged with the duty of supervising this contest and of preparing rules and regulations governing the same, a general summary of which is herewith given.

RULES AND REGULATIONS.

1. It will be assumed that every contestant is acquainted with the rules of the contest, and by entering therein he agrees to abide by said rules. In the event of dispute concerning the interpretation of the rules, the decision of the contest committee shall be final. The committee reserves the right to alter or amend these rules from time to time as it may deem expedient.

2. The contest shall be open to all classes of self-propelled vehicles made in the United States or abroad, but no manufacturer, agent or private owner shall be allowed to enter more than three vehicles in any one class. Application blanks will be forwarded by the secretary of the club upon request.

3. *Entries.*—(a) The time for receiving entries will expire on Aug. 31, 1901. (b) All entries must be accompanied by the following information in full: Weight of the motor vehicle, including fuel, supplies and equipment; capacity of water and capacity of gasoline; number of miles, with the number of passengers, the vehicle is able to run on ordinary roads without any replenishing of fuel or water; maximum and minimum rate of speed for each vehicle; full name of manufacturer; place of manufacture; rated horse-power of the motor; number of cylinders, bore, length of stroke and normal speed of engine.

4. *Entrance Fees.*—(a) The entrance fee for all classes, motor cycles excepted, up to and including Aug. 15, 1901, shall be $50 for each vehicle; in the motor cycle class the entrance fee shall be $25 for each vehicle; after Aug. 15, 10 per cent will be added to the entrance fee for all classes. (b) The entrance fees shall be paid to the treasurer of the club at the time application for entry is made. (c) Any person making an entry agrees that in the event of the vehicle being disqualified or failing to take part in the contest, the entry fee shall be retained by the club. (d) The club shall have the right to refuse an entry without stating any reasons.

5. *Passengers.*—In classes A, B and C, each vehicle shall carry at least two persons; these may be changed and others substituted within the confines of any control, but if passengers be changed outside of control the vehicle shall be subject to disqualification.

6. *Starting of the Contest.*—All entries for the contest shall appear in person before the committee at the Automobile Club on Friday morning, Sept. 6, 1901, and after giving full information as required by Rule 3 (b), receiving their official number and being officially recorded, shall then go to a place designated by the committee and have their entry examined by the committee's representative, the carriage weighed and an official seal affixed thereto.

7. *Disqualification.*—(a) Disqualification shall mean that on notice being served on any vehicle, it shall cease to run in the contest and shall not receive a certificate of mention in the records. (b) A person on receiving notice of disqualification shall withdraw his vehicle and immediately remove the official number therefrom. (c) No notice of disqualification shall be served unless the person in charge of the vehicle has first been notified of the act which it is claimed should disqualify the vehicle. If the act be disputed, disqualification shall be postponed until the contest committee, at a meeting to which all concerned shall be invited, shall take evidence and render their decision. (d) The person so disqualified shall have no claim on the club of any kind or nature whatsoever.

8. *Protest.*—(a) Any contestant has the right of protest, but the committee may refuse to consider such protest. In the matter of protests, the contest committee or its official representative may interfere. (b) Any contestant entering a protest must do so in writing, and shall substantiate the grounds of his protest. The party protested against shall have the right of being heard in opposition. If the party protested against does not admit the accuracy of the protest, the matter shall be adjudicated by the contest committee. (c) All protests must be filed within 24 hours of the time of the commission of the act against which protest is made. (d) All parties making protests shall be required to make a deposit of $10, which shall be forfeited in the event of the protest not being sustained, the intention being to put a penalty on frivolous, immaterial or unsubstantiated protests which would consume unnecessarily the time of the committee.

9. *Class Letter and Number.*—(a) Each contesting vehicle must have securely attached to it in a conspicuous position on both front and rear, an official letter and number corresponding with the catalogue class and number. There shall be no other mark or sign on any vehicle other than the owner's initials and the manufacturer's usual name or number plate as affixed to a vehicle when sold to a customer. (b) Those having charge of vehicles will be held responsible for the plates being in conspicuous positions and clearly legible.

10. *Road Stewards.*—Stewards shall be appointed and located where it may be necessary to stop contestants or require them to drive at a limited speed, and the stewards shall see that the instructions are strictly followed.

11. *Road Regulations.* (a) All vehicles going in the same direction must pass other vehicles to the left in accordance with the rules of the road, and vehicles meeting each other must pass to the right. Vehicles must keep to the right of the center of the roadway, except when there are no approaching vehicles and the conditions are such that it is impracticable to travel on the right side of the highway. If for any reason it is necessary for vehicles to travel on the center or left side of the roadway such vehicles must cross to the right side, irrespective of the condition of the roads, as soon as signaled by an overtaking or an approaching vehicle. Vehicles must signal one another when approaching in either direction. (b) No vehicle shall be pushed or assisted by any one other than its occupants under penalty of disqualification, except that the penalty for a vehicle being towed in any period shall be disqualification for that period. (c) Contestants shall be responsible for any violation of law and for all civil and criminal penalties. (d) Contestants must comply with the traffic regulations of the local police. (e) If a contestant fails to stop his vehicle on request from the driver of a frightened horse, or in any manner shows himself inconsiderate of other users of the roadway, his vehicle shall be subject to disqualification. (f) Contestants shall inform themselves thoroughly in regard to the route and no allowance will be made for any mistakes they may make. (g) No contestant shall take any route other than that laid down in the official maps which will be furnished for each stage.

12. *Controls.*—(a) Controls are to be officially established at the beginning of each day's run, at lunching places and at the end of each day's run. The start is to be made each morning at 8 o'clock, and an hour and a half will be allowed for luncheon. Any contestant arriving at the noon control at 12 o'clock or after will be allowed but one hour for luncheon. He will be called one hour after the time of his arrival and his time will be counted from the time that he is called; but no vehicle will be allowed to leave the noon control before 1 o'clock. (b) The noon control will open at 11 a. m. and close at 3.40 p. m. (c) The night control will open at 4 p. m. and remain open until 9.20 p. m. (d) The time of arrival of each vehicle at the point of control shall be recorded by the officials at control on the record sheets, and also on the record book of those in charge of the vehicle. (e) The site of control shall be designated by a red flag with the word, prominently printed thereon in black, "Control." This flag shall be prominently displayed on both sides of the road at the point of control. There shall be notification by means of a green flag at 200

yards in advance of the control point as a warning of the approach to the control. (f) Controls are to be established in the following manner: If a green flag is displayed, the vehicle should slow down to a speed of not to exceed 8 miles per hour until a white flag is passed, when speed may be resumed as before; on coming to a red flag, the vehicle shall come to a full stop until the driver is permitted by the steward to proceed; at night, lanterns similarly colored may be used instead of flags. (g) Provision for shelter will be made at night. Vehicles may take on fuel and supplies at the noon control and at stopping places for the night, where supplies will be provided. Any vehicles requiring supplies at other points will be required to make their own arrangements for the same. (h) There shall be at each night's stopping place a storage enclosure or tent, in charge of a superintendent and assistants, for the storage of vehicles for the night. Watchmen will be on duty during the night. (i) Passes will be furnished to vehicles granting them admission to or exit from the official enclosure provided for the storage of vehicles at each night control.

13. *Hill-Climbing Contest.*—(a) Controls are also to be established on the hill-climbing contest near Little Falls, or any other place that may be chosen by the committee. (b) One-half mile from the base of the hill a yellow flag, with the letter "H" thereon in black, will be prominently displayed at each side of the road as a warning of approach to the hill. A short distance from the base of the hill a second set of flags will be placed. The vehicles will line up, in the order of their approach to the second flag, on the right side of the road, allowing 10 ft. space between vehicles. Each vehicle will be started at a given signal by the proper officials. (c) The time and manner of the performance on the hill will be officially recorded. Time will also be taken on reaching the summit of the hill. (d) This trial will be a separate contest. The time occupied from reaching the control at the base of the hill to leaving the control at the summit *will be deducted from the general running time.*

14. *Speed.*—(a) No credit for speed exceeding 15 miles an hour will be allowed. (b) Attention is called to the general State law covering speed, and all contestants will be required to conform thereto.

15. *Starts and Stops.*—(a) Vehicles will be started from the control the first morning at 8 o'clock, except in Class E, which may start earlier by arrangement. At the time of starting from each control, the vehicles shall approach the starting line and take their places one behind the other in the order of their approach to the starting line, leaving a space of at least 10 ft. between each vehicle. As each vehicle starts, the others shall move up one place. Any vehicle failing to keep its position in the line shall fall out and go to the foot. (b) Vehicles approaching control points shall follow the same rule as at starting points. (c) If it becomes necessary for a vehicle to stop, it must first be driven to the extreme right of the road as nearly as practicable.

16. *Certificates.*—(a) The committee shall post the results of each day's run as soon as practicable, and may furnish the same to the press. (b) Contestants shall not publish or communicate for publication any other times than those contained in the club certificate. (c) In the event of any subsequent alteration by the committee of the records on the certificates, owing to protest or other causes, the contestant will only publish the records as amended, on pain of disqualification. (d) The certificates will recognize no speeds in excess of 15 miles an hour, but will, for a vehicle, state as follows: Official No., Class, Maker, Entered by, Weight, Record for....day of ....1901, Number of passengers carried, Route, Distance, Average miles per hour.

17. *Stages.*—The total distance is to be divided into stages for each day on the basis of approximately 85 miles per day. Following are the stages with the approximate distance: First stage, from clubhouse to Poughkeepsie, 90 miles; second stage, from Poughkeepsie to Albany, 70 miles; third stage, from Albany to Little Falls (including a hill-climbing trial near Little Falls), 85 miles; fourth stage, from Little Falls to Syracuse, 85 miles; fifth stage, from Syracuse to Rochester, 90 miles; sixth stage, from Rochester to Buffalo, 80 miles; total distance, 500 miles.

18. *Basis of Classification.*—All vehicles, whether electric, steam, gasoline or otherwise, shall operate in the same class, which classification shall be on the basis of weight.

19. *Classification and Division.*—Vehicles shall be divided into the following classes: All four-wheeled vehicles to carry two or more persons. Three-wheeled vehicles carrying two passengers side by side and conforming in all other respects to four-wheeled vehicles, to be provided for by special arrangement in classes A or B.

Class A.—Under 1000 lbs. class; four-wheeled motor vehicles weighing 2000 lbs. or over, in commercial running and operating condition, with all tools, fuel and supplies on board.

Class B.—1000 to 2000-lb. class; four-wheeled motor vehicles weighing between 1000 and less than 2000 lbs., in commercial running and operating condition, with all tools, fuel and supplies on board.

Class C.—2000-lb. and over class; four-wheeled motor vehicles weighing 2000 lbs. or over, in commercial running and operating condition, with all tools, fuel and supplies on board.

Class D.—Motor cycle class; motor bicycles, motor tricycles and motor quadricycles.

20. *Conditions.*—The conditions of this endurance test shall be average speed for the six days, and any competitor falling below an average of 8 miles per hour (except in Class E) for any one period shall not receive any credit for that period.

21. *Awards.*—Certificates shall be awarded by the club as follows: First class certificate, average speed from 12 to 15 miles per hour; second class certificate, average speed from 10 to 12 miles per hour; third class certificate, average speed from 8 to 10 miles per hour.

22. *Public Delivery Vehicles* shall be classified as follows: *Class E.*—Light Delivery: Load not less than 500 lbs., exclusive of operators, fuel and water; 10 to 12 miles an hour for first class certificate; 8 to 10 miles an hour for second class certificate; 6 to 8 miles an hour for third class certificate. Heavy Delivery: Load to be not less than one-half rated capacity, minimum to be not less than 1500 pounds; 8 to 10 miles an hour for first class certificate; 6 to 8 miles an hour for second class certificate; 4 to 6 miles an hour for third class certificate. Trucks: Load to be not less than one-half rated capacity, minimum load to be not less than 3000 lbs.; 6½ to 8 miles per hour for first class certificate; 5 to 6½ miles per hour for second class certificate; 3½ to 5 miles per hour for third class certificate.

W. M. POWER, *Chairman,*
W. E. SCARRITT,
HARLAN W. WHIPPLE,
Committee on 500-Mile Contest.

S. M. BUTLER, *Secretary,*
753 Fifth Avenue, New York City.

Women as Automobilists in Europe.

It is noted that whatever else may be said of the great Paris-Berlin automobile contest, there is no doubt that it triumphantly demonstrated the skill and pluck of lady motorists, and at the same time convincingly proved that even a racing machine is a sufficiently docile and manageable monster to be safely guided and controlled over 750 miles by a feminine hand. Mme. du Gast was the heroine of the fast race, being the first competitor of her sex who ever entered in a contest of the kind. The Prince de Sagan traveled beside her in her blue car, called the Valkyrie, as her mechanician, but she alone drove throughout the journey. That she was by no means a tourist in disguise, but a racer in earnest, is shown by the place which she secured—nineteenth—and her time—21 hours. Her voyage was without incident, save for the inevitable punctures, and was rendered pleasant by the attentions of enthusiastic admirers.

In the tourists' section there were whole parties of ladies and families of children. Unfortunately, the car driven by Mme. Lockert and her two daughters broke down hopelessly somewhere near Gotha, so that its three venturesome occupants had to relinquish their journey. But many other ladies successfully reached Berlin. One chauffeur traveled alone with his wife, who was often to be seen on the road actively assisting him to remedy one or other of those breakdowns which must happen in the best-regulated motor cars. Another, who also was his own mechanician, used to be helped on similar occasions by his wife and their son, a boy of 10. Baron von Zuylen's party of six included ladies, while the Baroness traveled alone with her mechanician on the ill-fated Snail, which was finally smashed up by a careless servant, who was alone in the car at the time and escaped unhurt.

Electrical Draughtsmen.

It is announced that an examination of applicants for electrical draughtsmen will be held at the Brooklyn Navy Yard Aug. 7. The pay of the position is $4 per day. On the same date a similar examination will be held at the Boston Navy Yard.

Military Telephony in New York State.

At the recent encampment of the National Guard of the State of New York at the State Camp, Peekskill, during the annual practice shooting and competition of the batteries of the light field artillery the First Signal Corps had an opportunity of demonstrating an action, the usefulness of the practical training it has received in the utilization of electricity in connection with military signaling. The information concerning the shooting was formerly transmitted by the agency of the old flag system, commonly known as the "wig-wag," and was found to work very slowly, requiring considerable time—more time than could be allowed for signaling to send the amount of information required. This year a telephone line three miles long was laid between the battery and the target. One telephone station was placed near the guns, as shown on Fig. 1, and the other at the end of the range near the target, where the effect of the firing could be seen, by a man stationed at the telephone, who immediately reported the result. The line was a typical military one, being reeled off from the back of a wagon and thrown into the bushes by the roadside and only suspended in the air where it crossed public roads or in front of gateways. Fig. 2 illustrates the manner in which a small tree was thus spliced with a short pole for the purpose of raising the line high enough to be above the ordinary traffic of the road. The line was of the most temporary character, no effort being made with regard to permanency. The line was grounded at each end, and the insulation between the conductor and earth was very low. The line and the station was finished two hours from the time of commencing work, the whole operation being conducted as though in actual warfare, the conditions as a signaling problem being exactly similar.

FIG. 1.—TELEPHONE STATION AND GUNS.

FIG. 2.—CROSSING A ROAD WITH TREE-POLE SPLICE.

The utility and success of the telephone when used in this way for military purposes depends on the rapidity of construction and perfection of instruments, which admits of no breakdown or delay. The instruments in this case were specially designed by a member of the corps to talk over a line in which the insulation between conductor and earth could be treated very nearly as a negligible quantity; and being well grounded at the end in case the circuit became interrupted, the induction telegraph which is a part of the instrument would have been brought into use. During the six days' practice the line worked perfectly, and conversation was carried on during the shooting at one time when the line had been accidentally broken. The First Signal Corps has been very successful in interesting its members in this important department of their work, everything it has undertaken in this line having been a success. Fig. 3 shows a group of its linemen who have mastered the laborious details of field construction, and are seen in the field ready and equipped for work. These men, it may be added, constituted a team which won the first military electrical trophy ever competed for, so far as is known, the trophy being one offered by the Military Athletic League in the tournament at Madison Square Garden.

FIG. 3.—GROUP OF MILITARY LINEMEN ON DUTY.

A New Higher Tariff for Germany.

The German Government organ has just published a pamphlet of 167 pages giving a draft of the proposed new tariff, which raises many duties, some of which are quoted below: Section VIII. of the bill also provides that dutiable goods sent to Germany from countries treating German ships and German goods more unfavorably than those of other countries may be assessed at double the rates provided for under the bill, or to the full value of the goods, and that goods on the free list arriving from such countries may be assessed 50 per cent of their full value. Americans in business in Berlin regard the bill as exceedingly bad for both Germany and the United States, pointing out that the sharp agitation during the last few years against certain American products has borne fruit in the measure. They express keen disappointment at the heavy increase in the duties on machinery. The present duties, ranging from 2½ to 8 marks per hundredweight, are in many cases more than doubled. In the case of saws the duty is quadrupled. American woods are also hard hit.

The proposed duties may be quoted as follows:

Steam boilers, from 5 to 8 marks per hundredweight.

Aluminum, hammered or rolled, 12 marks; lead, rolled, 3; copper, wrought or rolled, 12; copper wire, 12 marks per hundredweight.

Steam engines, 3½ marks per hundredweight.

Machinery for wood, iron and stone working, from 20 marks on machines weighing 2½ hundredweight to 4 marks on machines weighing 10 tons. Steam thrashers and mowers, 9 marks per hundredweight.

Miscellaneous machinery, from 3 marks 50 pfennigs to 18 marks per hundredweight.

Dynamos and motors, from 9 marks per hundredweight on machines weighing 5 hundredweight or less to 6 marks on dynamos and motors weighing from 5 to 30 hundredweight.

Telephone and telegraph apparatus, 60 marks per hundredweight.

A special cable dispatch from Berlin of July 27 says: The *Post* interprets Paragraph VIII. as directed against the United States, and says: "It gives us the means to protect ourselves against the high-handed manner in which the United States interprets reciprocity. We are decidedly discriminated against under present conditions. We were weaponless against such treatment in tariff matters because Caprivi literally threw away the most favored nation treatment. This new tariff showed a determination to insure ourselves a place in the sun in tariff matters, and we expect German manufacturers to agree thereto, since many have suffered from the supercilious morality of Americans in tariff treatment."

The *National Zeitung* contends that the Government must be shown that its new tariff scheme is incompatible with the commercial and social interests of the country.

Vorwaerts says there is only one answer to the bill: "Down with it!"

The Boerse to-day took a pessimistic view of the bill, and a general fall in the prices of iron and coal shares resulted. The *Boerson Zeitung*, in its report, says: "The view prevails on all sides that the new bill will be full of danger for Germany's industry and trade."

With regard to the argument that Paragraph VIII. of the bill will be the best means of convincing foreign countries of the value of commercial treaties with Germany, the Liberal papers emphasize the fact that the bill comes at a time when German industries are already in the throes of the severest of crises, and say it can only cause new convulsions in industrial life. These papers express the fear that the United States will adopt reprisals upon German shiping, and point out that Germany's allies, Austria and Italy, must lose a large part of their German trade.

A. I. E. E. Meeting Place at Buffalo.

As has already been announced, the meeting place at the Pan-American Exposition of the American Institute of Electrical Engineers is to be the New York State Building. Through the courtesy

NEW YORK BUILDING, PAN-AMERICAN EXPOSITION.

of the State authorities and the energy of Professor G. F. Sever, the use of this handsome building has been secured, and a more handsome and comfortable place could not have been selected. A view is shown herewith of the building, which is to be a permanent edifice, and which has cost nearly $200,000. It is in design a Doric temple, exteriorly, and the material used is white marble. Within are the offices of the State Commission, and sundry rooms that answer admirably for gatherings such that of the Institute. At the close of the Exposition the structure is to be turned over to the Buffalo Historical Society, in whose care it will become a repository of relics and records connected with the development of the State and the region. It will be remembered that at the Paris Exposition last year, the meetings of the Institute were held in the United States national pavilion on the banks of the Seine.

CURRENT NEWS AND NOTES.

WIRELESS TELEGRAPHY TESTS ON LINERS.—Tests in wireless telegraphy were made on Saturday last, July 27, in New York Harbor between the steamships Lucania, Cunard liner, and Kaiser Wilhelm der Grosse, of the North German Lloyd fleet. The former was leaving port for Liverpool. The tests were satisfactory until she had passed out of Quarantine, but after that the operators on the German liner failed to get the messages, which were received so faintly that they could not be deciphered.

NEW CHINESE CABLE LINES.—According to Consul Fowler at Che-Foo, a second cable has been laid between Che-Foo and Taku, connecting Peking with the world. This action was taken on account of the cable between these ports having been seriously interrupted. The nature of the damage is not stated by the Consul. He says he believes the Germans have had their lines from Shanghai and Tsin-Tau duplicated. There are now, says Mr. Fowler, three telegraph officers at Che-Foo—the Joint Cables, the German and the Chinese.

NEW ITALIAN SUBMARINE BOAT.—The Italian Navy Department, as a result of experiments last week, makes claim to possessing the finest submarine vessel in the world. The experiments, which were conducted at Spezzia, will have to be taken on trust, for only Italian naval officers were permitted to be present, and it is stated that the actual working crew of the submarine boat was composed for the occasion of men of commissioned rank in order better to guard the secrets. Engineer Albrizzi, however, stated that the submarine boat Delfino traversed at good speed under water the whole Bay of Spezzia, and launched a torpedo against the side of the armor-clad Verese, despite the fact that the latter had been warned to expect an attack. The Delfino is fitted with an apparatus invented by Albrizzi by which it is said the range of vision is extensive and photographs can be taken under water for a distance of 100 yards.

TROLLEY REPAIR STATIONS.—The Brooklyn Rapid Transit Company is about to put into operation a new scheme for quick repairs on its various lines. Most of the delays on the Brooklyn trolley roads are caused by either the breaking of a wire or accidents to the motors of the cars. Very often the repair wagons are a long time in reaching the scene of the accident because of the distance that must be traveled. The company now proposes to overcome this by establishing emergency stations, on the plan of the city's fire houses, in various parts of the borough. The buildings will be all of one general design, and will be built of brick, two stories in height. They will be completely equipped with all the latest appliances and appurtenances for the purposes for which they are intended, and will contain living apartments for the crews of repair men. Each crew will consist of five men. In each building the living apartments will be on the second floor. As in the fire houses, a brass sliding pole will be placed in each building to enable the men to descend quickly when a call comes in.

LONDON UNDERGROUND.—Last week we gave some details as to Mr. Yerkes' plans for the London Metropolitan and District underground roads. A dispatch from London of July 26 says: At a meeting of the stockholders of the Metropolitan Railway held this afternoon, the electric traction dispute was the principal topic of discussion. The action of the directors of the Metropolitan in opposing the proposals made by Charles T. Yerkes to fit the road with electricity was approved. The chairman of the meeting said that the expert electricians of both the Metropolitan District and Metropolitan Railways had approved the Ganz system of electric transit. The chairman said that his company was advised that the cost of the Ganz system would be from 30 to 40 per cent below that of the system advocated by Yerkes, and that when the Parliamentary Committee having the matter in charge had settled the question of a system, the Metropolitan Railway was ready to carry this system into effect. Mr. Yerkes and his associates offered to guarantee 3½ per cent on the ordinary stock, instead of the present lower rates; but the directors decided to issue fresh capital to make the installation themselves. "It is hardly fair to condemn us on account of our being an American syndicate," said Mr. Yerkes. "Americans do not condemn concerns in the United States because they happen to be British. I do not know a single great railroad in the United States which is not owned materially by Englishmen; and I think that fully one-third of the fire insurance in the United States is British."

MONO-RAIL IN ENGLAND.—The committee of the House of Commons to which the matter was referred has sanctioned the introduction of the mono-rail electric system between Liverpool and Manchester. As the Lords have already sanctioned the proposal the adoption of the scheme is practically certain.

THE MORSE TORPEDO BOAT.—A special dispatch from Paris of July 25 says: The newspapers are enthusiastic over the successful feat of the submarine torpedo boat Morse. Admiral Fournier ordered the Morse to proceed from Cherbourg to Havre and there torpedo the gunboat Cocyte. The Morse arrived at Havre after a run of 11 hours. Eight miles off the harbor she was submerged and fixed a torpedo to the gunboat without being discovered. She then returned to Cherbourg.

PNEUMATIC MAIL TUBES.—The directors of the Commercial Exchange, Philadelphia, have got up a petition signed by firms representing $200,000,000 capital and asking the President and Postmaster-General to restore the pneumatic tube service for that city. The document contains the indorsements from trust companies, banks, manufacturers, financiers, millionaires, capitalists, business men, merchants and influential property owners. There is an opportunity here for the adoption of electric methods.

ALASKAN CABLE.—With regard to the Kerite cable now being laid in Alaskan waters, a special dispatch of July 27 from Seattle, Wash., says: The party which is to lay the new cable between Juneau and Skagway will leave this city within the next two weeks. The work will be done by a cable manufacturing concern of New York City. The length of the new line is to be about 126 miles. A steamboat has been chartered and especially fitted up for the purpose, and is now on her way to this city from San Francisco.

MAXIM ON ELECTRIC TRACTION.—Sir Hiram Maxim, speaking in London on July 26 at a meeting of the Maxim Engineering Company, said that electric railways were revolutionizing American city life and property values, whereas Great Britain was deplorably behind in the matter of electric traction, which has spread out populations and mitigated some of the greatest evils of modern cities. Sir Hiram asserted that light electric roads were capable of 120 miles an hour; that their construction was perfectly practicable, and that their cost would be cheaper than that of the present steam lines.

NO FARE FOR SICK CHILDREN.—The St. Louis Transit Company issued a notice last week that caused favorable comment all over the city. The notices were put in each street car owned by the company. It read: "During this period of excessive heat and until further notice children 10 years of age or under, and one member of the family whose parents are unable to pay transportation will be permitted to ride free on Transit Company lines to Forest, O'Fallen, Tower Grove and Carondelet Parks on presentation to the conductor of a doctor's certificate certifying that in his judgment these would be benefited by an outing. This order in effect on and after July 24. St. Louis Transit Company." First Vice-President Corwin H. Spencer said on the subject: "In discussing the matter it was suggested that a physician's certificate might cost more than fare for the little ones. We do not believe, however, that any doctor would ask compensation in a case like this."

THE NEW YORK CENTRAL TUNNEL has been under investigation the past week, with a general consensus of testimony that the traffic ought to be handled by electricity. Dr. Cyrus Edson, ex-president of the New York Board of Health, in a special report, says: "There is still another source of contamination of the air in the cars, which are lighted by Pintsch lights. It is a general rule laid down by sanitarians that a 3-ft. gas burner, which is about the size of a Pintsch burner, should have 9000 cubic feet of air per hour. The gases of combustion, plainly apparent to the senses while the cars are passing through the tunnel, are mainly carbon monoxide, and dioxide and sulphur dioxide. All of these gases are very poisonous, and in sufficient quantities will destroy animal life. Carbon monoxide is the most poisonous. Five-tenths of 1 per cent of this gas will destroy animal life very quickly. Symptoms of breathing small amounts of this gas are dizziness, headaches, nausea, vomiting, debility, dry, irritating cough, and a train of symptoms similar to those of malaria." This is true of all train lighting other than by electricity.

ELECTRIC BURGLARS.—Some days ago a burglar caught a-burgling in New York was found to have on his person a small portable electric lamp of the compact cylindrical type, employing a small dry cell as a source of current. The New York sensational papers gave undue prominence to the case, owing to this new application of the electric light, but the correspondent of the London *Mail* capped the climax in the following cablegram: "Twentieth-century burglars, equipped with scientific burgling implements, have made their appearance here. The New York police to-day arrested two thieves who had been committing extensive burglaries in wealthy suburban districts. One burglar carried an electric bludgeon operated by a storage battery, and capable of shocking and stunning a person. He also had an electric saw and jimmy for opening safes. His companion carried an electric lamp instead of the old-fashioned oil lantern. The two burglars were well-dressed, and had good manners. They are said to be skilful mechanics. The police say that the electric bludgeon is one of the most dangerous weapons ever seen."

TROLLEY SUPERVISION IN CONNECTICUT.—The new law placing the electric street railways of the State under the supervision of the Board of Railroad Commissioners has become operative. The Commissioners now have exclusive jurisdiction and direction over the method of construction of street railways, and authority to designate the kind and quality of track and materials, and the method of applying the motive power. No trolley system can be opened to public travel until the Commissioners formally certify that it is in suitable and safe condition. They are required to inspect every trolley line periodically, and to recommend from time to time to its managers the adoption of such measures as the dictates of public safety and welfare sugest. They are authorized to employ an electrical engineer and as many experts as may seem desirable. Any railroad company that feels aggrieved at any ruling of the Commissioners is authorized to appeal to the Superior Court. Hitherto the electric railroads of Connecticut have been without any general State supervision, although they carry nearly 65,000,000 passengers annually.

TANDEM RAILWAY INDUCTION MOTORS.—In the tandem connection of motors for electric railway purposes, the induced member of the motor which is connected with the source of supply, supplies current to the inducing member of a second motor, the induced member of which is short-circuited on itself. When the motor equipment consists of two members connected in tandem and driving a common load, both motors will operate at one-half the speed at which they would run if both were directly connected to the source of supply. Under this condition the frequency of the currents flowing in the interconnected windings of the two motors is one-half the line frequency, or one-half the frequency of the current supplied to the first motor, and the frequency of the current flowing in the induced member of the second motor is substantially zero. The motor directly connected to the source of supply must, of course, carry the magnetizing current for both machines. In addition, since the full frequency and voltage of the source of supply are impressed upon the windings of its inducing member, the core loss in this member will be a maximum, and the core loss in the induced member half what it would be at zero speed. On the other hand, since the frequency of the currents flowing in the inducing windings of the second motor is only half that of the source of supply, the core loss in this member will be only about half as large as the core loss in the inducing member of the first motor, and the core loss in its induced member will be nearly negligible. As a consequence, the heating of the motor which is No. 1 in the tandem connection, will be very large as compared with the heating of the motor which is No. 2. Two patents issued July 23 to A. H. Armstrong relates to the equalization of the heating of the two motors of such a tandem system, which method is especially useful in connection with electric railway systems where there are heavy grades. In such systems the core loss in the No. 1 loss is often exceedingly large, and this motor may often get dangerously hot when operating on a road having heavy grades, while the second motor remains comparatively cool. One patent relates specifically to a switching system whereby one of the motors will be operated part of the time connected to the main source of supply, and for part of the time as the second motor in the tandem, the arrangement being such that the heating of the two motors during the day's run may be substantially equalized.

A CORRECTION.—In the biographical sketch of Mr. E. W. Rice, Jr., which appeared in our issue of last week, faulty proof-reading caused the given name of Mr. Rice to appear "Edwin William" instead of "Edwin Wilbur."

ELECTRO THERAPEUTICS.—The American Electro-Therapeutic Association will hold its eleventh annual convention in Buffalo, on Sept. 24, 25 and 26, 1901. Its headquarters will be at Hotel Niagara, and its place of meeting at the Armory of the Seventy-fourth Regiment.

PROFESSOR J. J. THOMSON.—The *Popular Science Monthly* for August opens with an article entitled "On Bodies Smaller than Atoms," by Professor J. J. Thomson, the successor of Lord Rayleigh and Maxwell in the chair of physics at Cambridge, who here describes for the first time in popular language the discoveries that have made him one of the leading living physicists of the world. The article is one that will be read with interest by everybody.

PAN-AMERICAN JURIES AT WORK.—The juries of awards at the Pan-American all met for the first time Monday morning, July 22, at the office of Dr. Pritchett, superintendent of awards. The different juries then separated to their various departments, and made a preliminary survey of the work. Lunch was served to all the jurors at the Stadium Restaurant by the Pan-American Exposition Company at 1 p. m., which custom will be followed as long as the jurors are at work. It is hoped to complete the work early in August.

"AUTOMOBILE HOUSE."—One of the cable dispatches from London says: What is the correct word for a private collection of automobiles equivalent to "stable" as referring to a number of horses? I have put the question to dozens of persons, and have yet to find any one with an answer ready at hand. The idea, of course, is a combination of coach and house, or, rather, motor and house, including both, and yet being neither singly. After considerable cudgeling and word twisting, among other suggestions offered have been "motorbarn," "motorome," "motorden," "motorium," "motor-shed" and "motable." One expert fell back on the French term "garage," but that, according to the general acceptance in London, is a place simply for storing and repairing automobiles, and comes no nearer filling the description of a gentleman's private collection than "livery" would describe his stable.

ARC-LAMP COMPENSATING WINDING.—After differential lamps have been in operation for a time certain changes in the "pick-up" and "feeding" voltages occur, due to the changes in the resistance of the magnet coils whereby the proper balance between them is disturbed. In a patent issued July 23 to Professor Elihu Thomson a means for overcoming this difficulty is described, which consists in providing an additional winding made of some metal having a low temperature co-efficient, such as German silver, which is connected around the series winding and in opposition therewith, at the same time assisting the shunt coil. As the resistance of the shunt and series coil increases, more current will flow through this third winding, and by proper adjustment as to length and cross section it may be made to compensate exactly for the decrease in the effect of the shunt coil. The same patent also relates to details of a carbon holder and contact device.

A MODIFIED THREE-WIRE SYSTEM.—In the usual form of the three-wire direct-current system two generators are employed, the neutral wire being connected between the generators. In a patent issued July 23 to H. E. Heath a modification of this system is shown, which consists in the employment of a third generator of double of the e. m. f. of the usual generators, which is connected to the outers, and with its two brushes also connected by equalizing wires to the outer brush, respectively, of the two main generators. All three generators are compound wound. With this arrangement of the generators a three-wire system will automatically regulate itself to the variations of current used by different series of translating devices, and its capacity can be increased as desired by connecting additional generators with the main wires without regard to their connection to the neutral wire, except through equalizing wires. A single generator may on this system also be connected with an ordinary three-wire system for increasing its output without disturbing the balance of the system.

MULTIPLE CIRCUIT ROTARY TRANSFORMER.—For a given frequency, as the speed of rotation of a rotary converter is reduced, the number of pole pieces must be increased, thus correspondingly increasing the number of, and crowding together, the commutator segments. In a patent issued July 24 to C. P. Steinmetz, a method is described of obviating this and some other objections due to the same cause, which consists in dividing the armature winding into distinct portions, each of which has its own commutator and set of collector rings, the latter being connected to independent transformers. By this construction the converter is made capable of delivering direct currents at different voltages, the direct-current terminals of the windings being connected in multiple for one voltage and in series for another voltage. Another advantage of this arrangement is that when connected to a three-phase circuit it gives the equivalent of a six-phase armature reaction.

PARAGUAY TELEGRAPHIC SERVICE.—A telegraph line from Asunción to Paso du Patria has been constructed, a cable being placed at the intersection of the Tebicuary River, so as to avoid the continuous interruptions by the boats navigating that stream. Another cable crosses the Paraguay River at Nueva Franca, joining the Paraguay telegraph line with that known as the Chaco line of the Argentine Republic. There is also in process of construction a telegraph line from Humaita to Curupayty, where another cable will be placed which will unite the Paraguayan line with that of the Argentine Republic at the colony of La Palma. Paraguay will then have three telegraph lines connecting the Republic with the rest of the world. Two other interior lines, one to the north and the other to the eastern part of the Republic, have been authorized by acts of Congress. The number of domestic telegrams sent in 1900 was 35,218. In that year 25,075 telegrams were received from other countries, and 23,276 telegrams dispatched to places outside of Paraguay.

SUBMARINE SIGNALING FOR BOSTON.—The Submarine Signal Company, of Boston, has obtained a special permit from the United States Government to erect a cable house on Egg Rock. The company proposes to establish its system of submarine signaling, described in these pages not long since, by which vessels bound into Boston Harbor may determine their precise position when within 10 or a dozen miles from shore, and thus escape the danger of approaching too near the dangerous shoals and ledges in the entrance to Boston Harbor. A permit has also been obtained by the company to erect a similar house on Minot's Ledge, and should the system prove as successful as the company hopes, scores of stations will be located at intervals of 10 miles or so along the entire Atlantic coast of the United States. The system is the invention of Arthur J. Mundy, a Boston electrician, and was perfected by Professor Elisha Gray, of telephone fame. Work on the Egg Rock station will start early in August. The new system will be in working order a few weeks after the station is built. The station at Minot's Ledge will be erected at the same time. A dynamo to generate current for the bell station near Nahant will be installed in the Egg Rock house, which will cost about $2,500.

LOCATING GROUNDS.—A method of locating grounds on electric circuits is the subject of a patent issued July 23 to E. M. Hewlett. Connected to the distributing mains is a differential galvanometer adjusted to a zero position under normal conditions of the line. If a leak should develop in either line the coils of the instrument are unbalanced and a corresponding indication given. When this occurs the resistances or other compensating devices are adjusted until the instrument is again brought to zero, and the amount of resistance still added is a factor from which the point at which the ground occurs may be easily determined. A switch is also provided at the distributing station by which the grounded main may be connected to a return wire, so that the resistance of the loop being tested may be easily ascertained. With a switch so placed that the two mains are connected in series relation, the two sides of the galvanometer are included in the loop, one end of which is grounded at the station through an arc machine or other source of high potential, and the other end of which is a possible ground at some point out of the system. The loop is normally open, but each sub-station is provided with means for closing it so that an attendant may insert a plug and complete the testing circuit when advised by telephone to do so. The method, therefore, relates to a distributing system provided at some point with an instrument and means for determining the resistance of each side of the circuit to any point within the range of the system.

THE TELEGRAPH IN ALASKA.—The United States telegraph system in Alaska has grown to such proportions that a large force of operators will be required. Acting Chief Signal Officer Dunwoody recently gave notice that he was prepared to enlist 20 to 30 telegraph operators to winter in Alaska.

WIRELESS IN THE NORTHWEST.—Arrangements have been practically completed, it is said, for the installation of the system on the boats of the Pere Marquette Railroad Company, as well as along the line of the road between Manitowoc and Ludington, Mich., which are about 62 miles apart, and between Milwaukee and Chicago. It is claimed that the cost of the wireless system is $150 a mile, as compared with the $3,000 of the wire system.

BROOKLYN BRIDGE.—Some of the short suspension rods and cable bands on the bridge were found broken last week, leading to a temporary interruption of traffic. The incident has caused much comment. Attempts to fix the damage on electrolysis have failed utterly. The extreme heat appears in part responsible, but the enormous development of trolley traffic is generally supposed to have at last thrown on the bridge a dead load greater than it is normally intended to carry.

INTERURBAN TROLLEYS FOR KENTUCKY.—The *Courier-Journal* says that the Louisville, Anchorage & Pewee Valley Electric Railway Company has completed arrangements with Eastern and Western capitalists to issue $18,000,000 of 40-year 5 per cent gold bonds. The purpose is to gridiron a considerable part of Kentucky with a system of interurban electric railways. The line running from Louisville to Pewee Valley is the trunk, from which branches will be run all through the Blue Grass section of the State, extending as far as Stanford and Richmond.

MUNICIPAL ELECTRICIANS.—Arrangements have just been completed whereby an electrical engineer of international reputation has agreed to prepare a paper to be read at the sixth annual convention of the "International Association of Municipal Electricians," to be held at Niagara Falls, N. Y., Sept. 2, 3, 4, 1901, on "The advisability of placing high and low potential wires or cables in the same series of conduits or through the same manholes." This is a live subject and just at present is an interesting topic in the section of the country in which we meet, particularly Rochester, N. Y. The New York party, which will number over 100 well-known electricians and dealers in electrical supplies, will leave New York on Sunday, Sept. 1, at 7.30 p. m. F. C. Mason, superintendent police telegraphs, Brooklyn, N. Y., has the matter in charge.

DINNER TO PAN-AMERICAN JURORS.—The members of the juries of awards and the directors of the Pan-American Exposition, enjoyed a banquet at the Stadium restaurant on July 26. President John G. Milburn presided. Among others at the head table were Director-General W. I. Buchanan, Treasurer George L. Williams, George P. Sawyer, Captain John Wisser, George Urban, Jr., and Mayor Diehl. The guests were seated at four long tables. The banquet began at 7.30 o'clock and the speechmaking began at 9.30 o'clock. President Milburn welcomed the guests. There were many excellent speeches. Professor Hollis, of Harvard, said that while he came from the oldest educational institution in the country, he came to the best educational institution in the world, for the time being. What impressed him was the use of engineering for beautification at the Exposition. Mr. Carl Hering spoke with particular reference to the electrical effects, and was followed by Dr. A. E. Kennelly on the same subject. "When 8.30 o'clock comes hereafter in my life I will think, 'This is the hour I saw the Buffalo Exposition grow into a crescendo of luminescence,' he said. "It is a grand poem of light."

CONSTANT CURRENT FROM CONSTANT POTENTIAL.—In 1890 Boucherot proposed an arrangement whereby with the use of an inductance and condenser in proper relation, a constant current may be obtained from constant-potential alternating-current mains, or constant-potential from a constant alternating current. In 1898 an elaboration of this system was the subject of a paper read by Boucherot before the Société Internationale des Electriciens, and at the recent Canadian Electrical Convention Professor R. B. Owens described the same arrangement in a paper which was printed in these columns. A patent issued July 23 to E. J. Berg presents a modification of the method, the object of which is to prevent such an arrangement from influencing the power factor of the main circuit with which it is connected. In one form of the Boucherot arrangement an inductance and condenser, which are so proportioned that when traversed by the same alternating current their voltages are equal in value, are placed in series across a constant-potential circuit. If now either the condenser or inductance is shunted by a circuit, a constant current will flow in this shunt circuit between wide limits as to load. In the arrangement as modified by Berg, the condenser and inductance in series are in addition shunted by another inductance (called a compensator), and one end of the constant-current circuit is connected to the middle point of this inductance or compensator. By this means the wattless currents flowing in the respective sides of the compensator equalize each other so far as the constant-potential circuit is concerned, with the consequence that the power factor of the main or constant-potential circuit is not affected. This arrangement also admits of the system being applied to a three-wire, constant-potential circuit, in which case the neutral wire is also connected to the middle point of the compensator. In a second Boucherot arrangement there are two sets of inductances and condensers in parallel. Bearing in mind the Wheatstone bridge diagram, the constant-potential circuit is connected to the two extremities of the triangle, the diagonally opposite legs of which containing condensers and inductances, respectively. The constant-current circuit is then connected to the other two angles of the triangle. In the Berg arrangement, instead of connecting the two opposite angles of the triangle directly to the line, they are connected to the extreme terminals of a transformer, the middle point of which is connected to the middle point of the constant-current circuit. Either of these arrangements, it may be remarked, can be also applied to the production of constant-potential from constant current. The second modified arrangement is claimed to have an advantage in that the wattless currents due to one set of reacting devices are compensated for to a greater or less extent by the wattless currents due to the other set, thus eliminating wattless current which would otherwise flow in the transformer windings, and thereby decreasing the waste of energy and increasing the efficiency of the transformer system. In a patent issued the same date to C. P. Steinmetz another modification of the Boucherot system is described. In this case a polyphase source of constant potential is used. Referring to the arrangement of inductance and condensers in the triangular relation above mentioned, and assuming two-phase currents, one side of the two-phase transformer is connected to opposite angles of the triangle. One end of the other side is connected at a third angle and the other end in series with the constant-current circuit, the other terminal of which is connected to the fourth or opposite triangle. It is claimed that by this means the range of regulation of the constant current system is practically doubled, and at the same time the regulation is rendered less sensitive to any higher harmonics which may appear in the e. m. f. acting in the constant-potential circuit.

LETTER TO THE EDITORS.

Mechanical Vibration of Wires.

To the Editors of Electrical World and Engineer:

Sirs.—I notice in the Digest of June 22 and July 20, 1901, an account of vibrations of wires, the latter abstract referring to the use of an influence machine as the exciter. I have frequently noticed such vibrations, and found they are caused by the nearness of two wires to each other, or if one wire only is used, to its nearness to some body; and I have frequently had to move the wires further apart from each other, or where one wire was used, have had to move it away from some body, such, for instance, as a wooden support.

The cause of the mechanical vibrations of the wires appears to be due to attraction; that is, where one wire, for instance, is used, the charges along the wire induce momentary charges of the opposite sign on some body in its neighborhood, and the wire is thereby attracted to it. The charges on the wire and opposite charges on the

near body being rapidly dissipated in space, the attraction ceases, and the wire swings back, and in virtue of its momentum, swings past its neutral position; another charge being imparted to the wire, it is again attracted to the body, and in this way it maintains a swing in time with the charges appearing on the wire.

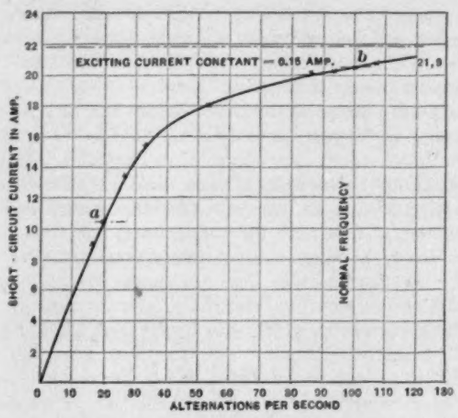
It is well known that a Geissler tube swung on such an excited wire will light up at the loops; the light appearing a maximum half way between two nodes, diminishing as a node is approached, and nearly if not entirely disappearing at a node. No mechanical vibrations, such as the writers above referred to give as a cause, would affect the light in a Geissler tube in that manner.

BALTIMORE, MD. ALFRED G. DELL.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Theory of the Short-Circuited Alternator.—HORSCHITZ.—An illustrated theoretical article. He starts from the well-known method of determining experimentally the armature reaction of an alternator by short-circuiting the armature through an alternating-current ammeter, while the exciting current of the field is slowly increased by means of a rheostat until the ammeter in the armature circuit indicates the normal supply current. The speed is kept constant. The ampere windings, which are then used for magnetization, are nearly equal to the ampere windings corresponding to the reaction of the armature in which the normal current flows, against the m. m. f. of the pole system. He develops theoretically by graphical methods the equation of the "short-circuit curve," which is experimentally obtained by the method mentioned above. The abscissas represent the exciting current, the ordinates the current in the short-circuited armature. The speed is kept constant. As is well known, this "short-circuit curve" is generally a straight line. His theory leads to the same result. He then refers to the experimental fact that for a certain excitation the short-circuit current varies only slightly when the speed, and therefore the frequency of the machine is varied between rather wide limits. He gives the formula for the variation of the current in the short-circuited armature with varying speed (or frequency), while the exciting current is kept constant. The current in the short-circuited armature is equal to unity divided by the square root of the sum of a constant value and the quotient of a constant value and the square of the number of alternations per unit of time. The adjoining diagram shows this relation, the



SHORT-CIRCUITED ALTERNATOR CURVE.

curve having been determined experimentally. It was found to be in good agreement with the theoretical result just stated. It is worth while mentioning that when any two points of the curve in this diagram have been determined (i. e., when the current in the short-circuited armature has been determined for constant excitation at two different speeds), it is possible to calculate all numerical values of the diagram of the short-circuited alternator.—*Elek. Zeit.*, July 4.

Windings of Direct-Current Machines.—FISCHER-HINNEN.—A communication referring to a recent article of Rothert who had claimed that, in order to have no sparks at the brushes, the teeth should be as saturated as possible. The present author claims that this statement does not agree with the actual practice, nor with the theory of commutation. He gives some data on machines of Krizik, which run without sparks at the brushes, although the teeth are not saturated. The eddy current losses in the teeth are 1 to 1.5 per cent, although the teeth are not saturated. He claims that with higher saturation of the teeth, as proposed by Rothert, the eddy current losses in the teeth would become very great.—*L'Eclairage Elec.*, April 27.

ROTHERT.—A reply to the criticism of Fischer-Hinnen. He says that his article referred to multipolar direct-current dynamos of average capacity. Fischer-Hinnen's examples are not of this kind. While Fischer-Hinnen said that the losses in the teeth are 1 to 1.5 per cent, "although" the teeth are not saturated, he would say that this is the case "because" the teeth are not saturated. When one saturates the teeth, their volume often diminishes more quickly than the losses per unity of volume increase. He claims that a theory of commutation which does not take the dimensions and the degree of saturation of the teeth into account, is insufficient, if not wrong. He gives some data about light machines which he has built.—*L'Eclairage Elec.*, May 25.

POWER.

Electric Power in a Packing Plant.—An illustrated article on the electric installation of a pork-packing plant in Chicago. There are three power plants. One contains a 375-kw, 240-volt, direct-current generator, supplying a 220-volt, two-wire system for both lighting and power. The second power house supplies about 3000 incandescent lamps at 16 candle-power at 220 volts, and 35 enclosed-arc lamps. The third generating plant is old, and supplies a 110-volt source for three small motors and about 1500 incandescent and five arc lights.—*West. Elec.*, July 20.

Electric Power in Slate Quarries.—BRUNSWICK.—The first parts of a long article on the electric power plant of a French company operating slate quarries. The power plant is near the quarries, so that a low-tension distribution at 120 volts is possible. The three-phase system is used, the frequency being 52. There are two 75-hp alternators, the power factor being 0.8.—*L'Elec.*, June 6, 15, July 13.

TRACTION.

Car Wheels.—Some comments on the car wheel problem. J. W. Fuller, Jr., Lehigh Car Wheel & Axle Works, states that they have continually urged their customers to increase the weight of the wheels, as many of those in common use are too light for the work. The customers, however, object to paying the additional cost. Pemberton Smith, New York Car Wheel Works, in a longer communication gives results and diagrams of the wear on steel-tired wheels; chilled wheels are often unsatisfactory because the managers will not pay sufficient price to obtain a good quality, but will pay much more than this price for steel-tired wheels. He advocates the use of first-class chilled wheels, and gives some examples of wear on this class of wheels when the best have been secured. He points out that although tram cars are approaching in weight the ordinary railroad cars of some years ago, the wheels used are much lighter, and that although the truck makers and motor makers are given all the room they require, the wheel makers are limited as to the length of the hub.—*St. R'y Jour.*, July 6, and Int. Ed., July.

The Proper Wheel Section.—SIEBER.—A communication on the proper wheel section for interurban railways, referring to a former article. He points out that unless the wheels used on the same axle are of the same diameter, there will be a tendency to flange wear, and where such a difference exists it increases rapidly as the wheel of smaller diameter is slid along the track. The wheel section used by him in Nuremberg is illustrated. He gives five reasons for the cause of unequal diameter in two wheels on the same axle, viz., difference in quality of the material in the tires, difference in the quality

of material in the brake shoes, bad adjustment of the brake, narrow, one-sided curves and poor measuring appliances. Cars with wheels of unequal diameters consume as much as 15 per cent more current than where the wheels are properly mated. The writer then speaks of the successful results secured by him in following the method of current distribution proposed by Henry (Digest, Sept. 15, 1900). The line suburbs are supplied with current at 580 volts, and those in the congested district at 520 volts.—*St. R'y Jour.*, July 6, and Int. Ed., July.

Polyphase Plant for Electric Traction.—H. S. Meyer.—An article in which he criticizes some special points in Eborall's paper, abstracted recently in the Digest. He does not consider damping devices inherent to rotary converters or their generators. He says that no final conclusion regarding hunting should be drawn from engine builders' guarantees concerning speed variation of different engines, so long as it is not known how the results were arrived at, and how they will compare with actual tests. He gives a brief illustrated description of a very sensitive method, used by the Gen. Elec. Co., of this country, for measuring the variations in angular velocity. He thinks that damping devices are only necessary where the angular speed variation cannot be kept within the limit of 2 degrees or less (from mean to maximum or minimum); that is, where the flywheel to accomplish this would get unproportionally heavy. He gives a handy way of calculating the necessary flywheel effect.—Lond. *Elec. Rev.*, July 5.

Eborall.—A reply to the criticism of H. S. Meyer, noticed above. Among other things he speaks of the use of damping coils. Whether these should be used or not with rotary converters is largely a matter of individual opinion when the phase displacement is as small as 2 degrees. Considering the insignificant cost of these coils and their great value should heating be set up, by a short circuit for instance, he always advocates their use in connection with the substation machinery with schemes of any magnitude, simply as a measure of precaution. The losses in the same are only 0.5 to 0.75 per cent. He has found in several instances that the addition of a flywheel to a synchronous converter has made hunting worse. Although he is not prepared to assert positively that such machines should always be designed to have as small a momentum as possible, still the experimental evidence available points to this conclusion as being the right one.—Lond. *Elec. Rev.*, July 12.

Railway Standardization.—An editorial referring to the fact that the negotiations with regard to electric traction on the "Inner Circle" in London drag their slow length along. The railroad is owned by two companies. One insists upon one system, the other upon another, the two systems being mutually exclusive. If the different railways of Great Britain would be equipped with different systems on its different lines, "the railway system of the United Kingdom would become a chaotic patchwork." It is claimed that the adoption of a system for suburban traffic will, in most cases, commit a railway company to that same system—as regards the line and rolling stock—for its entire network of lines. Standardization is needed. "Compulsory standardization would probably be necessary if it is to be effective. Parliament is the supreme authority in such matters, and the only authority strong enough for the task." "Not merely is it necessary to choose between rival polyphase and continuous current systems. Details need to be closely specified. The working voltage on the line, the frequency—if alternating currents are finally selected—the position of the working conductor, its height and shape and the method of protection. All these matters require to be rigidly standardized, if our railway system is to preserve its unity."—Lond. *Elec.*, July 12.

Automobile Omnibus.—An illustrated description of an Hub-motor omnibus to be used by a Chicago company. The vehicle has a seating capacity of 44 passengers. The "hub-motor" is used, the electric power being applied directly to the hubs of the four wheels supporting the vehicle, making each wheel an active driver. Charging stations are at the terminals of the line, so that the battery need not be constructed for more than a 12-mile run. With a full load of 11 tons it is estimated that the consumption of current will be about 80 watt-hours per ton mile.—*West. Elec.*, June 13.

REFERENCE.

Suspended Railway.—Luedorf.—A very long and well illustrated detailed description of the suspended electric railway of the Langen system, between Barmen, Elberfeld and Vohwickel, Germany, which has been repeatedly mentioned in the Digest.—*Elec. Zeit.*, June 27.

Wires, Wiring and Conduits.

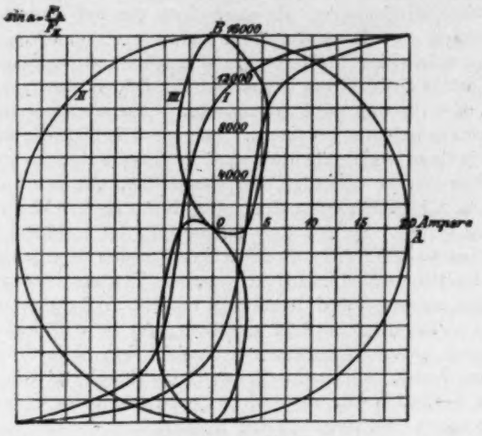
REFERENCES.

Standards for Rubber Insulated Wires.—A reprint of the standards for rubber insulated wires, proposed by the Union of German Elec. Eng.—*Elek. Zeit.*, June 27.

Overhead Construction.—Thornton.—An illustrated paper read before the Can. Elec. Ass'n, on "Construction and protection of aerial systems."—*West. Elec.*, July 13.

Electro-Physics and Magnetism.

Graphical Determination of the Angle of Hysteretic Advance of Phase.—Jacobson.—A description of a simple graphical method of determining the angle of hysteretic advance of phase. The hysteresis loop is plotted on cross-section paper with the induction as ordinates and the exciting current as abscissas, with such a scale that the total length of the abscissas axle *O A* is equal to the maximum ordinate *O B*, as shown in the adjoining figure. Then the sine of the



HYSTERESIS CURVE.

angle of hysteretic advance of phase is equal to the ratio of the area of the hysteresis loop to the area of the circle with the radius *O A*. This circle may at the same time be used for plotting the current curves in polar co-ordinates (for determining the effective value), as is done in Curve III. The determination of the "equivalent sine wave" can thus be made very quickly.—*Elek. Zeit.*, June 27.

Temperature and the Photo-Electric Effect.—Zeleny.—A long illustrated paper on the influence of temperature upon the photo-electric effect. His experiments show that this influence is large. From a platinum wire the negative electricity is at first discharged more slowly as the temperature is increased; the rate of discharge reaches a minimum, however, and then increases as far as the highest temperature used, about 700 degs. C. The rate of discharge produced by the light also depends upon the immediate previous history of the wire. From an iron wire the rate of discharge also appears to diminish at first with the temperature, but after reaching a minimum it finally becomes a great many times its value at room temperature. Heating the wire does not change the inactivity of the light for discharging positive electricity, even though the wire is raised to a temperature at which, due to the heat alone, the positive electricity is being discharged. The fact that after the platinum wire has had its temperature reduced, the larger conductivity of the higher temperature persists for a time, there being a gradual recovery, shows that at least most of the variations noticed in his experiments are due to changes taking place at the metal surfaces, and not in the gas between the electrodes. A comparatively abrupt change in the effect at about 100 degs. C. may indicate some molecular alteration of the metal.—*Phys. Rev.*, June.

Energy Absorbed by Vacuum Discharges.—Cardani.—A continuation of his researches in which he had found that the form of discharge in a gas is characteristic of its physical condition and independent of its chemical nature. He distinguishes 14 successive stages of evacuation, beginning with the ribbon-shaped spark at pressures from 650 to 320 mm. This is followed by a complete brush, a spreading brush, a luminous cathode (6 mm.), the beginning of the dark cathode space (0.7 mm.), the extension of the dark space over 8, 20, 35 and 50 mm., respectively, white brush at the anode, wandering brushes at the anode Röntgen rays and disappearance of luminosity. All these successive stages are reached at the same pressure in air,

hydrogen and carbonic acid gas. The maximum energy in proportion to the total energy is consumed at a pressure of 130 mm., just where the spark gives way to the brush discharge. The minimum is when the cathode phenomena become well marked, and the dark space is about 8 mm. long. On further exhaustion the energy rises again to near the maximum, but the appearance of Röntgen rays is not marked by any discontinuity. If cathode rays are due to a special form of ionization, it follows that the energy required for generating the electrons is always the same.—*Phys. Zeit.*, June 29; abstracted in Lond. *Elec.*, July 12.

Harmless Röntgen Rays.—DEMERLIAC.—Röntgen rays sometimes give rise to mortifications of the skin. The present author has found that tubes worked by alternating currents of high frequency and high-tension never produce erythema, and that on the contrary, the rays so obtained possess the curative properties recognized in electro-therapeutics since the experiments of D'Arsonval, Oudin, Doumer and others. He therefore uses the Oudin resonator, which, with certain precautions, may be made to work Röntgen ray tubes. They light up on connecting them with the upper knob of the apparatus. A broad concave cathode and a small anode or an annular anode are used. The cathode is joined to the resonator, and the anode may be left free or put to earth. The discharge is most effective when it proceeds in one direction only. A cathode valve should be very useful. The tubes may be brought quite close to the skin without risk, and thus any loss of penetration power is effectually counteracted.—*Comptes Rendus*, June 24; abstracted in Lond. *Elec.*, July 12.

Europium.—DEMARCAY.—In his researches on electric fluorescence in a vacuum in 1885, Crookes mentioned a band which he attributed to samarium, and which, on account of its disappearance, in presence of calcium, as well as for other reasons, he called the "anomalous ray." The present author has now identified this line with the spectrum of a new element intermediate between gadolinium and samarium which he calls europium, with the symbol Eu, and an atomic weight of about 151.—*Comptes Rendus*, June 17; abstracted in Lond. *Elec.* July 12.

REFERENCES.

A Principle of Dualism in the Theory of Electricity.—SIRE DE VILAR.—A long mathematical article in which he shows that there is a principle of "dualism" extending over the whole theory of electricity. Ohm's law may be written in two forms, either the voltage drop is equal to the product of resistance and current, or the current is equal to the product of conductance and voltage drop. The one formula is obtained from the other by replacing voltage drop by current and resistance by conductance or vice versa. In an analogous way from any formula another corresponding formula may be deduced. This is discussed by numerous examples, the discussion being restricted to the theory of direct current phenomena.—*L'Eclairage Elec.*, May 18, 25.

Globe Lightning.—VIOLLE.—A description of a globular lightning discharge.—*Comptes Rendus*, June 24; abstracted in Lond. *Elec.*, July 12.

ELECTRO-CHEMISTRY AND BATTERIES.

Edison Battery.—DE CONTADES.—An illustrated article on the new Edison accumulator. After an abstract of Kennelly's paper the following critical remarks are made. The Edison accumulator is said to have a capacity of 30.85 watt-hours per kilogram of electrode, for a discharge rate of 0.93 ampere per square decimeter. This is compared with the capacity of a modern Fulmen lead cell, which for a discharge rate of 1 ampere per square decimeter "has a capacity per electrode" (this probably means per kilogram of electrode) of 22.5 ampere-hours, at an average voltage of 1.9 volts, hence 42.75 watt-hours. (This comparison is very unfair. From Kennelly's paper it is evident that 30.85 watt-hours is the capacity of the Edison cell per kilogram of total cell, not per kilogram of electrode). He then gives a comparison of the Edison cell and a modern lead cell, with reference to the weight of the electrolyte and finds an advantage in favor of the lead cell. (This is evidently wrong. He says that the weight of the electrolyte in the Edison cell is 14 per cent of the weight of the electrodes, while according to Kennelly's paper it is 14 per cent of the total cell weight). He further says that the Edison cell will be expensive, and believes that it will not be durable. (One of the principal claims of Edison is that there is practically no deterioration).—*Cosmos*, July 6.

Edison Battery.—KRIEGER.—A communication in which he says that he has used nickel for positive accumulator plates before Michalowski and Edison. He patented a zinc-potassium hydroxide-nickel battery in 1896. The e. m. f. was experimentally found to be 1.82 volts, which corresponds exactly with the theoretical value if the chemical process at the nickel plate is assumed to be the change of the peroxide of nickel into nickel oxide.—*L'Ind. Elec.*, July 10. (See page 170.)

Diaphragms.—LE BLANC.—A German Electro-Chemical Soc'y paper on diaphragms in electrolytic cells. In the plant of the company with which he is connected, they use, for the regeneration of chromic acid, diaphragms which involve a loss of voltage of only 0.20 volt. In the meanwhile another material has been made for diaphragms which gives only half the resistance of the former. With this new mass a drop of voltage of 0.17 volt is produced by a plate of 5 mm. thickness with a current density of 300 amperes per square meter. With the older mass the voltage drop was 0.4 volt. The older mass consists of 75 per cent, SiO_2, and 25 per cent of Al_2O_3, while in the new mass about 2 per cent of the aluminum oxide are replaced by alkali. The Pukall material contains 70 to 71 per cent of SiO_2, 27 to 28 per cent of Al_2O_3, and about 1.5 per cent of alkali. He then gives an account of tests which show that plates of equal electric resistance may have a very different (mechanical) permeability for liquids and dissolved substances. He made tests with porous plates of equal electrical resistance and of equal size. He put on both sides of the plate, dilute sulphuric acid and on one side some chromic acid also. Some of these plates allowed a diffusion of 30 times as much chromic acid to the other side in the same times as other plates. It has been found that such a great permeability may be decreased without increasing the electrical resistance by placing the plate in a "solution of water glass of a certain concentration, another salt soluble in water being added." After the pores of the plate have been filled with the solution, the plate is dried and "placed in an acid." Plates with very fine pores which cannot be seen with the bare eye have a smaller (mechanical) permeability for liquids than such with larger pores, but must not necessarily have a greater electrical resistance. The electric resistance of liquids is inversely proportional to the cross section. This has been found to be correct for very thin capillary tubes. On the other hand the (mechanical) permeability is proportional to the square of the cross section. A diaphragm may be regarded as a system of capillary tubes. With equal total cross-section of all the pores and equal electrical resistance, that diaphragm which has the finer pores, has the smaller (mechanical) permeability. An ideal diaphragm is theoretically possible with extremely fine pores, combining a small electrical resistance and a very small (mechanical) permeability.—*Zeit. f. Elektrochemie*, May 30.

Sulphide Ore Treatment.—ASHCROFT.—A long illustrated abstract of a paper read before the Brit. Inst. of Mining and Metallurgy; also some editorial notes on it. The paper deals with the treatment of sulphide ores, and is a description of the modified Phœnix process for extracting the silver, lead and zinc by a combiantion of metallurgical, chemical and electrolytic reactions. The modified process has been worked out by Swinburne and Ashcroft, after an earlier process of Swinburne had not proved satisfactory. The principle of this earlier process consisted in feeding the crushed but unroasted ore into a bath of molten zinc chloride and in electrolyzing the semi-molten mass thus obtained with a molten lead cathode and carbon anode. The lead was to be removed first by electrolysis, and then the zinc, while the sulphur was to be separated and recovered at the anode. The new modified process differs from the old one in the following points: The removal of the sulphur by substitution of chlorine, the removal of lead by substitution of zinc, and the removal of iron, manganese and gangue by settling. In other words, a comparatively pure fused mass of zinc chloride is submitted to electrolysis in place of the mixture of sulphides and chlorides, used in the earlier process. Editorially it is remarked that although the inventors appear to have surmounted in some cases the metallurgical and mechanical difficulties of the earlier process, it is yet too early to assert that the modified Phœnix process has successfully solved the sulphide ore problem.—Lond. *Elec.*, July 12.

Commercial Aluminum Zinc Alloys.—J. W. RICHARDS.—No alloys containing more zinc than aluminum have any specially valuable mechanical properties, nor even the alloy of equal parts of both. The alloy "Al-2, Zn-1" reaches a tensile strength of 40,000 lbs. per square inch, melts at 425 degs. C., does not easily oxidize, and takes a fine finish. It closely resembles a high carbon steel in character, and is the hardest and strongest of the Al-Zn series. Its specific gravity is 3.8. A contraction of 17 per cent takes place during alloying. The alloy "Al-3, Zn-1" is the most generally useful of the

series. It is softer than the last tensile strength, 35,000. It is not malleable, but yet not brittle, bending before breaking. Hence castings may be straightened out. Specific gravity, 3.4; contraction, 14 per cent; good castings are yielded. When made from pure metals, it is equal to finest brass in the lathe and under the drill and file. Its color is equal to that of aluminum. Below 25 per cent zinc the strengths of the alloys decrease rapidly. The 15 per cent alloy can be rolled and drawn; tensile strength, 22,330 lbs. per square inch.—*The Alum. World,* May; abstracted in *The Elec. Chem. and Met.,* June.

Electrolytic Production of Metallic Chromium.—Neumann.—A German Electrochem. Soc'y paper in which he gives an account of experiments made to determine the proper conditions in which metallic chromium can be obtained by electrolysis. The experiments were made with a double-fluid cell. The cathode side contained a solution of chloride or sulphate or acetate of chromium, while the anode side contained mineral acids or salt solutions. As cathode carbon was used, as anode lead or platinum or carbon. To get good deposits the liquid at the cathode must be thoroughly stirred. Only at certain limits of concentration, current density and temperature it is possible to get good deposits of metallic chromium.—*Zeit. f. Elektrochemie,* May 30.

Galvanic Coppering of Aluminum.—Gianoli.—The metal is cleaned of all fatty substances by means of a 10 per cent sodium hydroxide solution, washed with warm water, then dipped into a 5 per cent hydrofluoric acid solution, and again washed. In order to cover the metal with a thin layer of copper it is dipped into a 10 per cent alcoholic solution of copper chloride until it has assumed a uniform color. It is then brought as cathode into an electrolytic bath of the following formula: Cyanide of copper, 300 grammes; potassium cyanide, 450 grammes; barium phosphate, 450 grammes; water, 500 grammes. The best voltage to use varies between 1.7 and 2 volts. He also gives formulas for silvering and nickeling.—*L'Elettrictita,* 1901, v. 20, p. 107; abstracted in *The Elec. Chem. and Met.,* June.

Pyrogenetic Reactions by Means of the Electric Current.—Loeb.—A preliminary account of some experiments in which he studied the effect of the carbon arc, using alternating current of 110 volts with 11 ohms series resistance on various liquids or vapors. In the cases in which a complete destruction of the substance occurred—especially with aromatic bodies with deposition of carbon, a metal wire which was heated by passing a current through it to a glowing condition, was used instead of the arc. Under the influence of the arc, water gave a gas consisting of about 50 per cent hydrogen, 40 per cent CO, 7 per cent CO_2, and 0.8 per cent unsaturated and 2 per cent saturated hydrocarbons. He also investigated methyl alcohol, glacial acetic acid, benzene, naphthaline, aniline and nitrobenzene.—*Ber. der Deutsch. Chem. Ges.,* 1901, v. 34, p. 915; abstracted in *The Elec. Chem. and Met.,* June.

White Lead.—Cowper-Coles.—An illustrated article on "Some electrolytic processes for the manufacture of white lead." The following processes are described: Gardner, Browne and Chaplin, Browne, Woltereck, Lucknow, Tibbit, Bottome, Lukon, Bailey, Cox and Hay, Bredig and Faber. He concludes that the chief difficulty with electrolytic processes has been the trouble experienced in getting the white lead free from metallic lead and obtaining a product that is of the right composition. The lead anodes are also likely to give rise to difficulties, through getting coated in such a way that their action is retarded, or, on the other hand, the lead disintegrates and particles of metallic lead are found in the final product. An ideal white lead should be composed of about two molecules of lead carbonate and one molecule of lead hydroxide. The analysis of a good white lead is about 69 of carbonate and 31 of hydroxide. As one ton of metallic lead produces about 1.25 tons of white lead, it is calculated that a fair profit can be made when the price of white lead is about equal to that of sheet lead.—*The Elec. Chem. and Met.,* June.

Solubility.—Rothmund.—A German Electro-Chemical Soc'y paper. In many cases the solubility of a non-electrolyte in water is changed, and generally diminished by the addition of a salt. This represents a difficulty to the theory of electrolytic dissociation, and shows that "the ions cannot be considered under all circumstances like other kinds of molecules." From the principles of thermodynamics he draws the conclusion that when the solubility of a non-electrolyte in water is diminished by the addition of a salt, then the solubility of this salt in water must be greater than in the solution of the non-electrolyte. He also develops the mathematical formulas. They were found to be in good agreement with measurements made by Wilmsmore.—*Zeit. f. Elegtrochemie,* May 30.

Formation Energy of Water and an Electrode Sensitive to Light.—Bose.—A German Electro-Chemical Soc'y paper, giving an account of experiments by which he found the free formation of water to be 52,654 calories, with a possible error of 693 calories, more or less. He also describes experiments with a gold anode which is covered by a film of gold hydroxide, which prove to be sensitive to light.—*Zeit. f. Elektrochemie,* May 30.

REFERENCES.

Storage Batteries.—Illustrated descriptions, taken from patent specifications, of the following new batteries: Edison, Renaud, Cheval-Lindeman, Brault, Gladstone and Beckett, McCartney and Majert.—*L'Eclairage Elec.,* June 8. A continuation of this serial, in which the following batteries are described: Skwirsky, Placet, Collins, Porter, Muhle, Hewitt, Boese, Ricks.—*L'Eclairage Elec.,* July 6.

Nickel Ammonium-Sulphate.—Pfanhauser.—A German Electro-Chemical Soc'y paper, giving an account of a theoretical and experimental investigation on "The electro-chemical behavior of nickel-ammonium-sulphate." This complex double salt is formed when ammonium-sulphate is added to a solution of nickel sulphate, the specific conductivity of the electrolyte being increased.—*Zeit. f. Elektrochemie,* June 13.

Velocities of Ions.—Steele.—An illustrated description of a mechanical appliance for demonstrating in the lecture-room the traveling of ions and measurements of transport numbers.—*Zeit. f. Elektrochemie,* June 27.

Aluminum.—Ohly.—An article on "Modern production of alum and aluminum." He gives a history of the methods of producing aluminum and discusses especially the process of treating bauxite. He refers to the uses of aluminum for electric conductors and for the reduction of refractory oxides.—*Min. and Met.,* July 15.

Units, Measurements and Instruments.

REFERENCES.

Pyrometers.—Rosenhain.—The first part of an illustrated article on electric pyrometers. After some general remarks on resistance pyrometers and thermo-electric pyrometers and on the methods of placing the pyrometer directly in the furnace or exposing it only to the heat radiation, he describes the Siemens platinum resistance pyrometer, the Griffith-Callender platinum resistance pyrometer and the Callender recorder.—*The Elec. Chem. and Met.,* June.

Electric Dynamometer.—Deroude.—An illustrated description of a new transmission dynamometer, devised by him.—*L'Ind. Elec.,* June 10.

Localizing High-Resistance Breaks on Cables.—Rymer-Jones.—A communication in which he gives the results of some actual tests with his method, noticed recently in the Digest. They show that his method is correct in principle and simple in application.—Lond. *Elec. Rev.,* July 5.

Telegraphy, Telephony and Signals.

Artificial Submarine Cable.—Trowbridge.—For demonstration purposes he uses the following arrangement. A number of resistances are connected in series between one pole of a galvanometer and a double key. The other pole of the galvanometer is earthed. The double key enables one to connect the line either to earth or to one pole of a battery, the other pole of which is earthed. Each junction of two resistances is connected to one plate of a condenser, while the other plate is connected to earth. The condensers he uses are short lengths of glass tubing about 1 cm in diameter, with a platinum wire as an electrode sealed in one end. The tube is filled nearly full of distilled water and the other electrode, which is a piece of platinum foil about 3 mm. wide, is corked in so as to dip about 5 mm. into the water.—*Phys. Rev.,* June.

Telephone Cable.—Baechtold.—An article on a new telephone cable in the St. Gotthard Tunnel, Switzerland. The total length is 16.6 kilometers. The construction of the cable is shown in the adjoining figure, which shows its cross-section in actual size. The cable consists of seven double wires of copper of 1.8 mm. diameter, with paper and air insulation. They are twisted together and covered with paper tape, the diameter being 7 mm. Around this is a three-fold layer of cotton tape; a mantle of lead, containing tin, and a second mantle of lead protect the cable against gases and water. Around the lead mantle there is an insulating compound layer.

Around this an armor consisting of 28 steel wires, and finally a cover of jute, impregnated with a compound. The external diameter is 44 mm. The electric properties were specified as follows:

NEW TYPE OF CABLE.

Copper resistance, 6.4 ohms per kilometer at 15 degs. C.; insulation resistance at least 1000 megohms per kilometer at 15 degs. C.; maximum charge, 0.06 microfarad per kilometer.—*Elek. Zeit.*, June 27.

REFERENCES.

Currents and Potentials on Submarine Cables.—CREHORE.—An illustrated paper in which he develops an approximate method for calculating the currents and potentials on submarine cables, produced by sine-wave e. m. f.'s. The method only applies to the transmitting end of the cable. The receiving end is perhaps the more important, for the signals must be received in legible shape, if the transmitter has any commercial value, but the transmitting end is also important, for it is there that the cable experiences the greatest potentials, and the insulating material the greatest strain. He applies his calculations to the example of an actual Atlantic cable. The results are given in a series of diagrams.—*Phys. Rev.*, June.

Wireless Telegraphy.—A long illustrated serial on the experiments in wireless telegraphy made between Brussels, Mechlin and Antwerp with the Guarini automatic repeater.—Lond. *Elec. Rev.*, May 24, June 7, 28; July 12. Another article on the same experiments by Poncelot, who participated in these experiments, is begun in Lond. *Elec. Eng.*, July 12. An article by M. Guarini appears elsewhere in this issue on the same subject.

Telautograph.—LETHEULE.—An illustrated description of the Ritchie telautograph for transmitting written characters or drawings over a two-wire telephone line.—*L'Eclairage Elec.*, June 1.

MISCELLANEOUS.

Electric Resistance of the Human Body.—HOOPER.—An account of experiments in which the hand-to-hand resistance of the human body was measured at all practicable voltages. Brass rods of about three-quarters of an inch in diameter were selected for electrodes, and the resistances were masured first with a Wheatstone bridge and a single Leclanche cell, and then with milliammeter and voltmeter and storage battery, varying from a few volts to 75 or 100, and sometimes to 125 volts. With the Wheatstone bridge and cell the resistances were always high, usually from 20,000 to 40,000 ohms; with the milliammeter and voltmeter and storage cells the resistances were always lower, decreasing along an apparently hyperbolic curve until with 100 to 125 volts the results obtained were usually between 1000 and 2000 ohms. He thinks that the diminished resistance might be partly due to increased flow of blood to the parts under the stimulus of the relatively large currents at high voltages. He made experiments with a special apparatus, and found that the resistance of the body during the first one or two-hundredths of a second after being subjected to potentials of from 50 to 100 volts is much higher than that found after the current has acted for several seconds. There are, however, probably also other effects of relatively large currents much more instantaneous in their action, but tending also to reduce the body's resistance.—*Elec. Rev.*, June 29.

REFERENCES.

Raoult.—An account by Abegg of the life and work of the late chemist and electro-chemist, Francois Marie Raoult.—*Zeit. f. Elektrochemie*, June 13.

Treating Lupus.—A long illustrated article on the method of treating lupus by means of the electric arc light, devised by Professor Finsen, of Copenhagen.—Lond. *Elec. Rev.*, July 12.

British Engineers in Germany.—Illustrated articles on the recent visit of the (Brit.) Institution of Electrical Engineers to Germany, especially to Hanover, Berlin and Dresden.—Lond. *Elec.*, *Elec. Rev.*, *Elec. Eng.*, June 28, July 5, 12; *Lightning*, June 27, July 4, 11.

Paris Exposition.—REYVAL.—An illustrated description of a 800-kw, 500-volt direct-current dynamo of Decanville.—*L'Eclairage Elec.*, June 1. Illustrated descriptions of 7-kw, 30-kw, 225-kw direct-current dynamos and a 176.5-kilovolt ampere, three-phase alternator of Alioth & Co., also of polyphase-direct current converters of the same company.—*L'Eclairage Elec.*, June 8. Illustrated descriptions of machines of the Comp. Internat. d' Elec. de Liege; two direct-current dynamos of 135 kilowatts and 45 kilowatts, respectively; an 80-kilovolt ampere, three-phase alternator, and 20-kw three-phase transformers; a 100-kw motor-generator for transforming three-phase currents into direct current.—*L'Eclairage Elec.*, June 15.

New Books.

PRACTICAL ELECTRO-CHEMISTRY. By Bertram Blount. New York: Macmillan Company. 374 pages, 47 illustrations. Price, $3.25.

In laying aside this book the reviewer has great pleasure in stating that he enjoyed its perusal. True, he probably would have stated certain facts differently, and introduced other material here and there had he attempted the preparation of a volume upon the same subject, but the fact remains that Mr. Blount has given the chemical public a readable and most acceptable volume. It will prove particularly valuable to chemists whose knowledge of electro-chemistry is very limited, and indeed it will reveal to them and to chemical manufacturers generally a new world. This new domain of chemistry, opened up through the "subtile agent" of Faraday, will cause chemists to pause, and probably will lead many to attempt the wider application of the electric current in chemical work.

Within the compass of seven sections or chapters the author covers admirably the most salient points in practical electro-chemistry. The introduction discusses the nature of electrolysis, constitution of electrolytes, theory of solution, ionic theory, etc., in a clear, comprehensive and attractive way. The busy practical man receives here in 32 pages the substance of some of the most important theoretical deductions of modern times, and the bearing of the same upon industrial work. The winning and refining of metals by electrolytic means in aqueous solution, in igneous solution, their alloys obtained in the electric furnace (carbides, borides and silicides), electro-deposition, the production of alkali, chlorine and their products, the manufacture of organic compounds and fine chemicals, and finally the power, are treated understandingly in their respective chapters. Forty-seven illustrations appear. They represent the more important forms of apparatus used in electrolytic processes.

The book cannot fail to prove a valuable addition to the library of all persons who are "interested in one of the youngest and most promising of modern industries."

A TREATISE ON ELECTROMAGNETIC PHENOMENA. By Commander T. A Lyons, U. S. N. New York: John Wiley & Sons. 556 pages, 385 figures and plates. Price, $6.

This volume has an introduction of nine pages in the place of the usual preface. Part I. occupies the whole of the volume; the other five parts of the complete work are to appear in another volume. The work can in no sense be accepted as authoritative, being frankly a compilation. The author says in his introduction that a complete list of the works consulted, read, or studied in the preparation of the book will be printed in a succeeding volume.

The subject matter of the parts is as follows: Part I., Electromagnetic Phenomena; Part II., The Compass; Part III., The Ship a Magnet; Part IV., The Mathematical Theory of the Deviations; Part V., Swinging Ship and Compensation of the Deviations; Part VI., Various Matters Bearing on the Main Subject.

The arrangement of the subject matter is unusual, the title of the first chapter being "A Medium Necessary to the Production of Magnetic Phenomena." The author therefore starts where some authors leave off. The next four chapters are a continuation of the wave theory. Chapter VI. is entitled "A General View of Electrical and Magnetical Phenomena," in which the elementary theory of magnetism and so much of electricity as is necessary are taken up.

The book then branches off again to discuss terrestrial magnetism in the next chapter. Chapter VIII. gives a pretty full description

of instruments used in the observation of terrestrial magnetism. Chapter IX. treats of sun-spots, auroras, etc., then at Chapter X. the book returns to the subject dropped with Chapter VI. Chapter X. is entitled "The Magnetic Condition in Bodies of Restricted Size; Field Around Them; Laws of Action; Effect of Heat on Magnetism." Chapter XI. entitled "Theories of Magnetism-Molecular and Terrestrial," comes next. In a book arranged in the ordinary manner, the subject matter of Chapters VI., X. and XI., would come in the first part of the book, while the discussion of the wave theory—and much more, cosmic magnetic phenomena—would come later. The author may have had some particular object in view when he arranged the contents in this manner, but if so he has not made it clear to the reader.

Chapter XII., the last, treats of the magnetic theory of light; the treatment is semi-popular, which may be said generally of the treatment of the other subjects also. In this chapter the method of juggling with dimensional formulæ, developed by Professor Rücker and his followers, is exploited. Both Professor Rücker and Professor W. Williams are quoted. The logic of this method was discussed in the columns of the *Electrical World* in the year 1897, and for the benefit of those who have never read anything on the subject it may be stated that the whole method is founded upon—or at least implicitly contains—the fallacious assumption that the dimensions of a physical unit depend upon the ultimate nature of the physical quantity of which the unit is the measure.

The chief criticism of the book is that it is disconnected. However, most of the material is obtained from reliable sources, and the book will probably prove of value to a certain class of readers.

EXPERIMENTAL PHYSICS. By Eugene Lommel. Translated from the German by G. W. Myers. Philadelphia: J. B. Lippincott Company. 664 pages, 430 illustrations. Price, $3.75.

This is a work upon elementary physics, and is excellently adapted to the use of elementary students. So far as electricity and magnetism are concerned the treatment is very much behind the times, many of the illustrations being archaic and some of the subject matter out of date. For example, the treatment of magnetism is wholly on the basis of poles and polarity. Nothing seems to be said concerning either magnetic flux or the magnetic circuit. It is hard to imagine how any adequate treatment of magnetism can at the present time be conveyed without treating of these subjects and from the standpoint of those subjects. In electricity the apparatus described is very ancient.

The chapter on light is excellent, and is the longest in the book. The book is well worthy study, if only for the sake of this one chapter, which presents more logical and clearer notions concerning abstruse optical phenomena than are perhaps to be found in any other text-book of the same character.

Although as a text-book the statements are generally accurate, yet there are errors of oversight which might have been avoided. For example, it is stated that "one kilogramme-metre is equivalent to 98,100,000 ergs." Of course, the author in making this statement had in mind the localities where the gravitational constant was 981, but the students would have been aided if the limitation had been distinctly expressed. There are some other errors attributable to translation which should have been avoided. For example, it is stated that the horse-power "is equivalent to the work of 75 kilogramme-metres." What should have been stated is that it is equivalent in Germany to the activity of 75 kilogramme-metres per second. The watt is also stated as being the 1-736th part of a horse-power, which was an acceptable proposition at the hands of the author in Germany, but is not an acceptable unqualified statement when the book is translated into English for English-speaking students.

ANNUAIRE POUR L' AN 1901. Publié par le Bureau des Longitudes. Avec des Notices Scientifiques. Paris: Gauthier-Villars. 936 pages. Price, 1 franc, 50 centimes.

This little volume, which has already passed through more than 100 republications, is a very valuable and interesting combination of ephemerides and statistics. It is a sort of scientific almanac published under the auspices of the French Government. It is wonderful how much useful information in physics, chemistry and astronomy it contains, mingled with a good deal of matter of especial interest to Frenchmen. Thus, there are 38 pages devoted to an enumeration of the various departments and townships in France with their several populations and their magnetic elements. Then follows an interesting series of French population tables from which it appears, among other things, that in all France about 9 per cent of the births are illegitimate, and in Paris 29 per cent; that there is one divorce to approximately 40 marriages; that among still-born children the ratio of males to females is 1.34; in legitimate births, 1.05, and in illegitimate births 1.02, there being 21 births living to 1 still-born. Moreover, in the year 1898, the births exceeded the deaths by approximately 34,000 or less than 1-10th of one per cent of the total population of France, showing that this population, while certainly not retrograde, is almost stationary in numbers.

While all scientists and nearly all progressive persons recognize that the French system of weights and measures ought to be universally adopted, and that the English-speaking countries are more conservative than progressive, in adhering to their existing barbarous systems of weights and measures, yet it is a pity that France officially adopts the meridian of Paris as its standard of longitude, in place of the meridian of Greenwich. The Greenwich meridian sets time for all the world except France, Russia and Portugal, which adopt the local meridians of Paris, St. Petersburg and Lisbon, respectively. The difference of longitude between Greenwich and Paris is 9 minutes 21 seconds. Let us hope that when the English-speaking peoples adopt the metric system of weights and measures France will consent to adopt the Greenwich meridian.

A very full chapter is devoted to the magnetic elements of France, which may be roughly stated as 14½ degs. W. declination, 64 degs. dip, and ⅕ gauss horizontal intensity. A very useful series of physical and chemical tables follows. There are two electrical papers by M. Cornu, one on electric units and the other on the electric transmission of power. Both subjects are treated from the theoretical rather than from the practical standpoint.

TELEPHONE LINES AND THEIR PROPERTIES. By William J. Hopkins. Revised and enlarged. New York and London: Longmans, Green & Co. 307 pages, illustrated. Price, $1.50.

This sixth edition of a book which first appeared in 1893, has had several of its chapters rewritten and has had a chapter on composite working and wireless telephony added. A number of half-tone pages have also been inserted. The subjects of its 15 chapters are as follows: Design and Construction of City Lines, Underground Work, Long-Distance Lines, Wire, Insulators, Exchanges, Switchboards, Propagation of Energy, Telephone Current, Measurement, Properties of City Lines, Interferences from Outside Sources, Properties of Metallic Circuits, Cables, and Composite Working and Wireless Telephony. There are also two appendices—one on oscillations and the other being based upon Carty's paper before the Institute on inductive disturbances in telephone circuits. The style of the book is semi-popular, and in construction has more the appearance of a compilation than a connected treatise. It would form a good basis for a course of lectures to those who wish to get a general idea of the subject. Those looking for a thorough discussion of the subject will have to look elsewhere. Of the new matter that of most importance is an abstract of the introductory non-mathematical portion of Pupin's paper before the Institute at its Philadelphia meeting.

INSTRUCTIONS FOR THE USE OF TELEPHONES. United States Signal Corps, United States Army. Prepared under the direction of General A. W. Greeley, Chief Signal Officer, United States Army, by Captain Samuel Reber, Signal Corps. Washington: Government Printing Office. 34 pages, 20 plates. Price, 75 cents.

By order of the United States War Department officers and men of the Signal Corps are obliged to familiarize themselves not only with the ordinary methods of operating telephone lines, whether the instruments are bridged or in series, but also with the various types of telephones as described in this volume. It is expected that every officer and non-commissioned officer of the Signal Corps shall be able to readily locate and remedy faults, whether they are in the instrument, in the battery, or on the line. After a brief and clear presentation of the principles of speech and of electromagnetic induction a general description of the functions and principles of action of the different elements of a telephone system is given. This is followed by a detailed description of the construction and operation of various commercial types of receivers, transmitters, magnetos, subscribers' sets and switchboards. The book is illustrated with 20 plates, reproduced directly from drawings which evidently were made expressly for the book. A very much better result would have been produced if the engravings had been made by the wax process, the cost of which would have been but a small part of that for finished drawings for direct reproduction.

The Westinghouse Industries at the Pan-American Exposition.

BY W. M. PROBASCO.

IT is altogether fitting and proper that Buffalo, situated by the great waters of the North, should invite the peoples of all countries to an exhibition representing the material growth of America. To celebrate the achievements of a century of progress in the Western world is said to be the aim and purpose of the Pan-American Exposition, and although there may have been one or two expositions exceeding it in extent, it is heralded as the most effective ever attempted. The point of greatest significance in any exposition is the thought that countries, like individuals, become provincial unless they exchange their resources, industries, products, inventions, arts and ideas. By increasing the countless articles needed by man, the machinery of the world has brought prosperity, wealth and leisure which in turn have given birth to the beautiful in art. It is, therefore, of the greatest importance that the electrical and mechanical inventions be brought together.

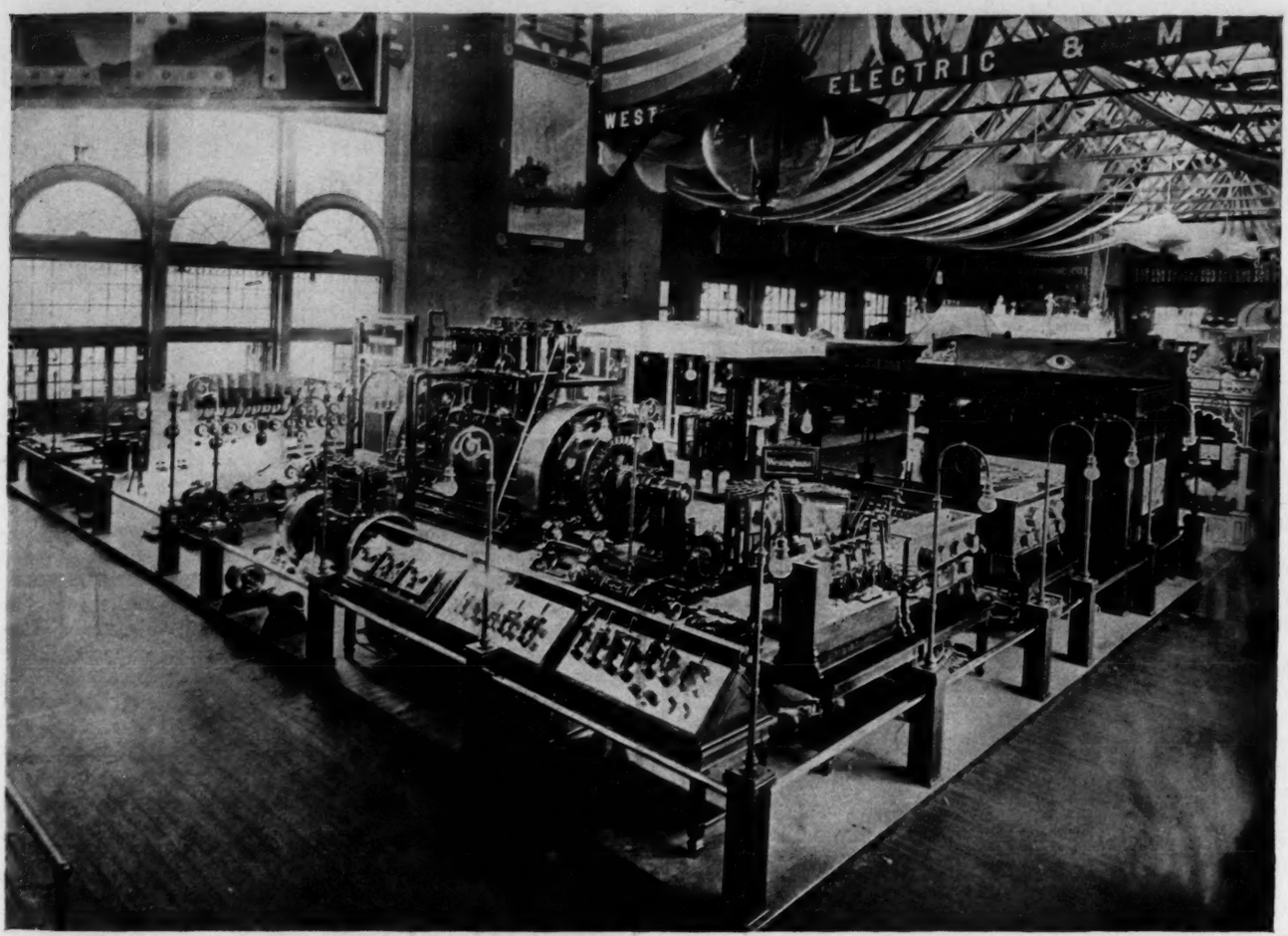


FIG. 1.—MAIN WESTINGHOUSE EXHIBIT IN ELECTRICITY BUILDING.

Worthy of the exposition as a whole are the exhibits of the Westinghouse Companies. It was in a broad and liberal spirit that these companies decided to make an exhibit at the Pan-American, for in the city of Buffalo and vicinity the Westinghouse Electric & Manufacturing Company alone has over 150,000 horse-power of electrical machinery in operation, including the ten 5000-hp generators which this pioneer electric company installed at Niagara Falls, at a time when the largest electrical machine built was about 2000 horse-power in capacity. It is this installation that has made possible the most brilliantly lighted of expositions and contributed so successfully to its operation. To the visitor at the Pan-American Exposition the numerous industrial enterprises associated with the name Westinghouse are in the main familiar. Almost every traveler by rail knows that his safety and comfort are in a large measure due to the Westinghouse air brake, which for 30 years has been the standard appliance for arresting the motion of trains. One million two hundred and fifty thousand of these brakes are now in service throughout the world. Those familiar with engineering affairs are acquainted with the very extended use of the steam and gas engines built by the Westinghouse Machine Company. Those who use electrical machinery, whether for lighting, power or traction, know the apparatus built by the Westinghouse Electric & Manufacturing Company. Equally well known are Westinghouse, Church, Kerr & Co., whose work practically covers the entire field of engineering as applied to power systems and their application to transportation, lighting and industry. The Union Switch & Signal Company, manufacturers of every known variety of automatic and semi-automatic railroad signals—makers of frogs and switches and of mechanical, pneumatic and electrical interlocking mechanisms of all kinds; the Sawyer-Man Electric Company, makers of incandescent lamps, whose product has been on the market for over 20 years. These are the Westinghouse Companies that have joined in a common exhibit.

Beneath the central dome of the Electricity Building and to the right and left of the main entrance to the Railway Exhibits Building occupying in all over 6500 square feet of space and truly representing the progressive spirit of this century the exhibits of these companies have been placed. The dome of the Electricity Building is tastefully draped with hanging green and lavender bunting, making a background upon which numerous strings of Nernst lamps festoon off from a large 2000-cp lamp placed in the center. There are over a hundred 400-cp Nernst lamps that contribute to this illumination, which is the first public exhibition of the Nernst lamp in America and a notable introduction of one of the greatest developments that has been made in electric lighting.

The operation of two gas engine-generating sets is one of the features of greatest interest in the Electricity Building. The large unit consists of a 300-hp, 3-cylinder, 4-cycle gas engine, direct coupled to a 2200-volt, two-phase, revolving field alternator. The smaller unit is a 3-cylinder, 4-cycle gas engine, direct connected to a 125-volt, direct-current generator. The power furnished by the

large unit is employed partly in supplying current to 130 Nernst lamps at 220 volts, and partly in operating numerous Westinghouse induction motors applied to stationary service. The small gas engine-generating set is used for exciting the large alternating-current generator, for lighting the switchboard, and for charging the storage sparking outfits for both gas engines. It is used also for operating the motor-generator outfit and for lighting four large electric signs, two of which are placed over the main entrances of the Electricity Building. The switchboard for controlling these generators is equipped with the latest type of measuring instruments, switches, circuit breakers and auxiliary apparatus. Other standard switchboards for lighting and power service are in place. A 375-kw alternator, revolving field type, 7200 alternations, is of particular interest.

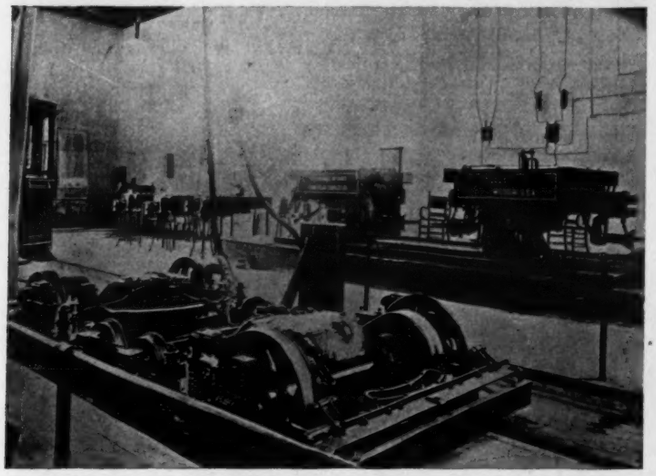


FIG. 2.—MOTOR TRUCK AND MAGNETIC BRAKE.

Of transformers there are to be seen a complete set of the company's O. D. transformers from ¼ to 50 kilowatts, two sizes of manhole-type transformers, and two 100-kw self-cooling, oil-insulated transformers. The latter are used to lower the voltage of the 180-kw machine from 2200 to 110 volts, at which potential they supply the four incandescent signs. These transformers present no radical departure from the excellent type which the Westinghouse Company has standardized.

One of the most novel attractions in the Electricity Building is a high-voltage sign. It consists of two large glass plates covered on the back with metal foil, with the name "Westinghouse" in its center. An alternating pressure having a maximum of 40,000 volts is applied between the foil on the back and the metal letters on the front. As the potential is raised a fringe of violet light appears about the letters which, gradually increasing in intensity, culminates in a myriad branched lightning discharge that plays continuously over the surface of the plate, and is accompanied by a continuous crash not unlike thunder.

Among the railway motors included in the railway exhibit are a Westinghouse 56 motor for heavy suburban and interurban service, a 50-C for heavy railway service, and a 69 motor for city and suburban service. These motors are split horizontally with their suspension on the lower half of the field. The pole faces are smooth and unbroken, and the armature possesses a ventilated winding. The 50-C motor is provided with a special cradle suspension from the car axle, thus removing the not inconsiderable weight of the motors from the car truck. This arrangement minimizes the wear of the rails, increases the life of the wheels and, what is most important, makes an easy riding car. There is also a large number of induction motors adaptable where constant speed is required, and of variable speed motors. These latter are provided with collector rings which serve to carry the induced currents of the secondary to an adjustable external resistance whose operation controls the speed of the motor. The company also exhibits a complete line of detail apparatus, including motors, lightning arresters, fuse blocks, switches, circuit breakers, etc. Included in this comprehensive and interesting exhibit are two large revolving photograph stands containing a great number of pictures which illustrate engineering work of importance, as well as various electrical and mechanical installations of the several companies.

Passing now to the Railway Exhibits Building, which is properly defined as containing all flanged wheel exhibits, we find in the southeast section of this building the exhibit of the Westinghouse Air Brake Comapny. A rack representing a six-car train, including the locomotive, is equipped with the high-speed brake. The air is supplied by four motor-driven duplex air compressors, which are also part of this exhibit. These compressors are especially adapted to supply compressed air for air brakes on electric motor vehicles as well as various other industrial uses. A complete equipment of both the straight air and the storage system of air brakes for electric cars is so arranged on the platform as to show their application to the car.

The necessity of using some sort of power brake to control railway cars operating in urban and interurban service, suggested itself immediately that electric traction became impracticable. The Westinghouse electric brake and car-heating apparatus shown in full operation at the exhibit, more nearly approximates, I believe, the ideal brake for electric cars than any other appliance heretofore invented. The apparatus consists of two elements, a brake and a car heater. The brake may be installed and used independently of the heater, but the operation of the heater is dependent upon the use of the brake, the produced heat being derived from energy that would otherwise be wasted. This combination of a magnetic track brake with a wheel brake of maximum power produces a braking effect greatly in excess of any heretofore attained. Moreover, cars equipped with the complete apparatus are heated without using the line current and therefore without cost for the electrical energy employed in heating.

This system is shown in operation in two exhibits. First, a standard single truck electric car is in constant service on a track extending from the main exhibit in the Railway Exhibits Building to a point east of the building some 250 ft. This car is equipped with the electric brake and car heater complete, and is in charge of a regular street car motorman, who is in readiness at any time to demonstrate the operation of the system to those interested. When in action powerful magnets force the brake friction shoes upon the rails and set up a strong magnetic attraction between the shoes and the rails, while at the same time the drag or back action of these magnet shoes throws in action a system of levers that apply to the wheels brake shoes of the regular type. The current for exciting the magnets is supplied by the motor which, through the proper wiring of the controllers, is at this time operated as a generator. With this electric brake system it is impossible to skid the wheels, and any degree of braking power is secured from the slightest effect up to a braking effect exceeding the weight of the equipment. Second, a double truck of the maximum traction type equipped with two 40-hp motors and with the electric brake, is operated on a short section of track by a stationary controller. This equipment shows

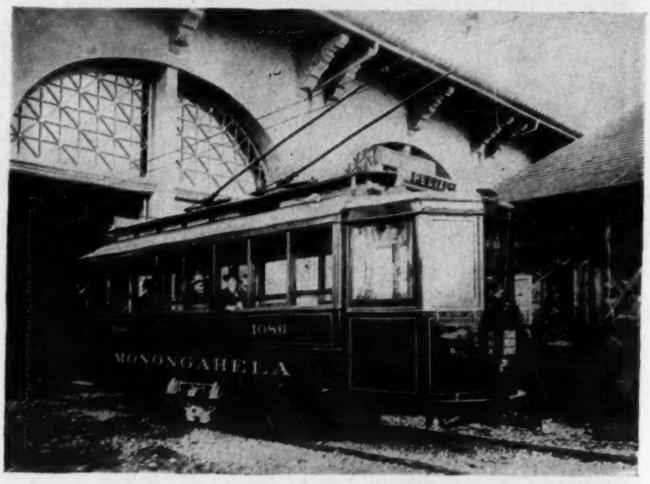


FIG. 3.—TROLLEY CAR EXHIBIT.

the enormous braking power of the apparatus and the absolute freedom from skidding of the wheels. The smooth action of this brake is one of its chief features, there being no shock or sudden jolts during its application.

The space occupied by the Union Switch & Signal Company is located just west of the Westinghouse Air Brake Company's ex-

hibit. It contains three of the most important signaling systems owned and manufactured by them—the Westinghouse electro-pneumatic interlocking and signaling system, the "wireless" system of automatic electric block signaling, and the high-speed electric train staff system. The electro-pneumatic exhibit is located at the west end of the space and consists of a two-lever section of the latest pattern, electro-pneumatic interlocking machine, a double-arm iron post signal, a dwarf signal, and a switch-and-lock movement operating a single switch point complete with detector bar, rocker shaft, electric switch, valve cylinder, etc. These appliances are connected and working. They represent a part of the signaling required for a

FIG. 4.—EXHIBIT OF RAILWAY SIGNALS AND SWITCHES.

single track main line turn out. Sections of some of the principal parts are also displayed.

The working of the "wireless" system of automatic electric block signaling is shown on a model track 50 ft. long, divided into two blocks and representing one line of a double-track railway with a side track connected at both ends for returning the model engine or car without running against traffic. The switch at the west end is also equipped with a switch instrument and indicators to illustrate the protection provided against misplaced switches, or trains from sidings entering on or fouling the main track.

Two of the Union Switch & Signal Company's latest type of electric semaphore signals—a single and double arm—are operated automatically from the model track and the complete exhibit shows plainly the working of automatic home and distant block signals under the "wireless" systems. Several of the separate appliances used in this and other systems are on view, including semaphore mechanisms and motors, battery chutes, relay boxes, cranks, wheels, jars, etc. Two of the high-speed electric train staff instruments connected and working show the practicability of operating trains on single track railroads by means of this system and without the use of train orders. Photographs and drawings of various appliances and plants built and installed by the Union Switch & Signal Company, together with a view of their new and greatly enlarged works at Swissvale, Pa., are also a part of the exhibit.

Altogether it may be said that under various names, but deriving their initial impetus and origin from one source, the industries to which I have directed attention, constitute one of the most impressive and interesting features of the beautiful Pan-American.

P. & B. and P. A. E.

The friends of the Standard Paint Company, manufacturers of the P. & B. goods, New York and Chicago, are receiving a cordial invitation not only to visit the P. & B. pavilion at the Pan-American Exposition, but to make it their headquarters. The invitation which is a handsome engraved steel plate card, reads as follows: "During your stay at the Pan-American Exposition in Buffalo, we cordially invite you to make your headquarters at our pavilion, which is located near the East Amherst Gate, directly south of the Canadian Building, where you can keep appointments or have your mail sent in our care. The Standard Paint Company."

The convenient location of the P. & B. pavilion near one of the gates of the Exposition and the unique character not alone of the exhibit itself, but of the handsome building in which it is placed, is attracting many visitors, curious to see it. The pavilion is a very interesting affair, being constructed entirely inside and outside, walls, ceilings and floors of the Ruberoid Roofing made by the Standard Paint Company. Ruberoid enjoys the distinction of occupying one of the seven or eight individual exhibition buildings at the Pan-American. The P. & B. pavilion is well lighted. The Ruberoid of which it is built is handsomely painted both inside and outside with oil colors. The exterior color scheme is white and gold, with the dome-shaped roof in blue. The interior is ornamented with designs of various kinds in appropriate colors.

The pavilion is the one which attracted so much attention at the Paris Exposition. Inside of it are shown samples of all the P. & B. goods, such as the Ruberoid roofing and flooring, insulating, building and lining papers, preservative paints and electrical compounds. Representatives of the Standard Paint Company are in constant attendance at the exhibit.

Lea Arc Lamps at the Pan-American.

The Lea Electric Manufacturing Company, of Elwood, Ind., has an attractive display of arc lamps at the Pan-American Exposition. One distinctive feature of all these lamps is the split cover on hinges which permits of easy access to the mechanism. The miniature lamp, which is one of the strongest features, burns on 2½ amperes on 110-volt circuit, or 1¼ amperes on 220-volt circuit, giving 75

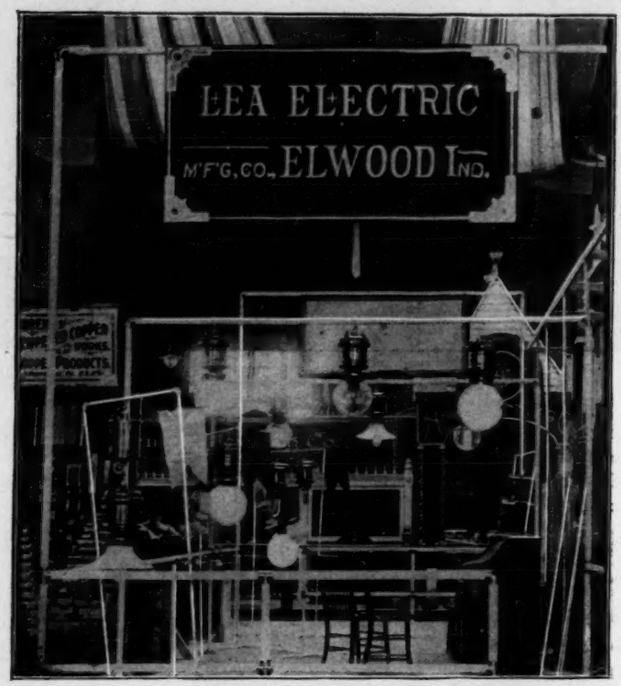


EXHIBIT OF ARC LAMPS.

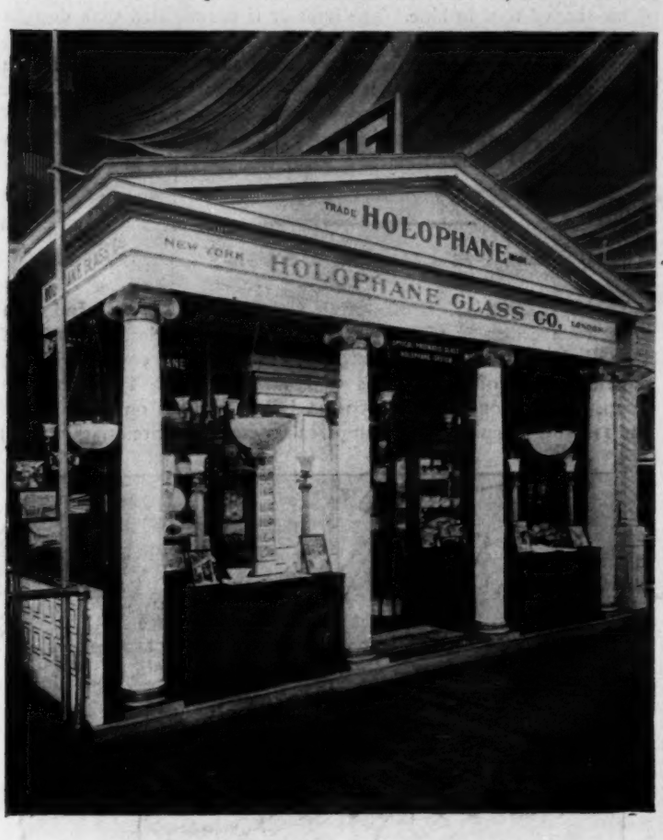
hours' life with 9-16-inch carbon. The regular alternating lamp takes 5 amperes at 90 volts on either 60 or 120 cycles. Regular direct-current lamps of similar size, for all voltages up to 500 are, of course, exhibited. Street railway men are interested in the Northall headlight, which is made to burn either direct on 500 volts or in series with incandescent lamps in the car, thereby doing away with wasteful resistance.

Electric Roads for Russia.

A St. Petersburg dispatch says that M. de Witte, Minister of Finance, will shortly go to Berlin to negotiate with German financiers in regard to electric tramways and other municipal enterprises in Russia. While in Berlin M. de Witte will probably confer with Count von Bulow, the Imperial Chancellor. Afterward he will visit London.

Holophane Exhibit at the Pan-American.

The Holophane Glass Company has hit upon a very simple and effective way of illustrating the quality of its wares to the general public at its Pan-American exhibit. In the rear of its very handsome booth, the exterior of which is shown in the accompanying illustration, is a dark room for photometric purposes. In this is a regular photometer with which the engineer can make tests. But that does not appeal to the great light-using public. Something less technical and more easily tried is necessary for the layman. One end of the room is partitioned off into two alcoves, the interior of



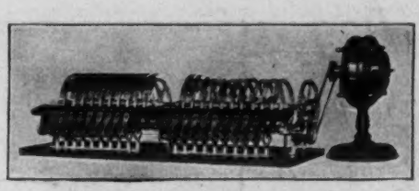
GLASS GLOBE EXHIBIT AT THE PAN-AMERICAN.

both of which can be seen from the other end of the room. The difference in illumination and diffusion between the lights covered with Holophane globes in one room, and those without in the other room can be seen at a glance, and is convincing to the veriest layman.

The Reynolds Flasher.

The "Original Reynolds Flasher" (current controller) is an automatic rotary jack-knife switch for controlling the current of incandescent lamps, transferring or switching the current from one or a cluster of lamps in any manner desired, giving what is called the flashing or changeable effect to incandescent lamps. The flasher is mounted on a slate base. The wheels or disks constituting the drum are revolved on a steel shaft by means of a gearing at the end of the shaft, which is driven by a small electric motor, usually a 12-inch fan motor. The wheels or disks have segments or lugs attached to the rim by clamps of various lengths, from 1-16 to about 8 inches long, these segments being adjustable so that an unlimited number of combinations may be made with them. On the front of the flasher is a slate shelf on which are fastened the blade holders or hangers, and the blades with fibre blocks are riveted to the ends. On the base is fastened a brass casting with improved flexible forks made of spring brass. As the drum revolves the segments on the wheels bear down on the fibre tips of the blades, the blades being driven into forks to close the contact. The service mains are connected to a brass bar on the base. The lead wires from sign to cluster of lamps are fastened to the blade hangers, thus the drum is only mechanical, no part of the flasher being charged with electric current excepting from the blade hanger to the bar holding the forks. The flasher is used in various ways for electric signs, show window decorations, electric flags and designs for out-door electrical displays. When attached to an electric sign the effectiveness and attractiveness of the sign is increased a hundred-fold by flashing on and off single letters or entire words. For electric flags it produces the waving effect. The combined points of economy, cutting down the cost of electric current, and its advertising power are a great incentive for business firms to use this flasher.

The "Original Reynolds Flasher" has been used for years, and it is made of few simple parts, resulting in a compact, well-built device that meets all demands. It is approved of by the National

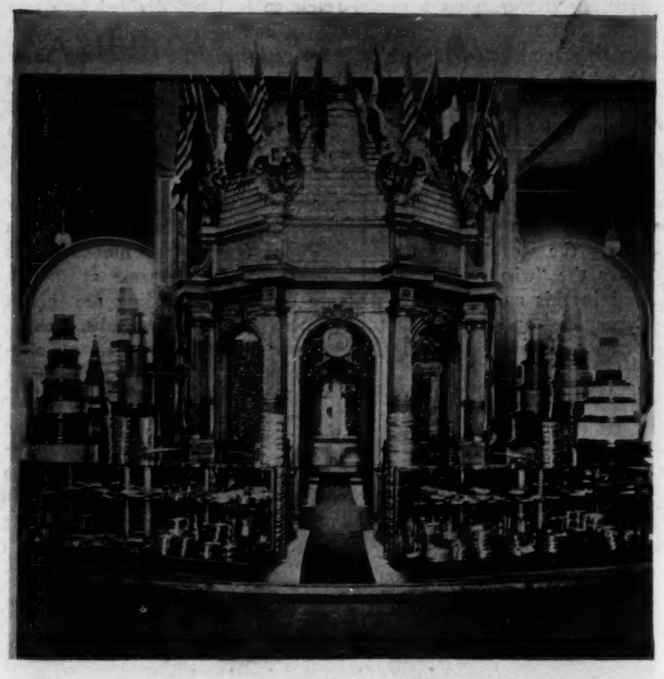


LAMP FLASHING MECHANISM.

Board of Fire Underwriters, and is being largely used by enterprising business houses. It is manufactured by Reynolds Electric Company, of Chicago.

American Steel and Wire Company at the Pan-American.

The American Steel & Wire Company in the Machinery and Transportation Building at the Pan-American Exposition has one of the most comprehensive exhibits in that line ever made in the industry. Every kind of wire or cable commercially manufactured is shown. Electrical men will be most interested in the display of copper and aluminum wires and cables of "Crown" brand, and also



WIRE EXHIBIT AT THE PAN-AMERICAN.

in the exhibit of rail bonds which is somewhat evolutionary in character. It begins with the "Chicago" rail bond, which was invented by H. R. Keithley, of the Chicago City Railway, in 1893, and which filled such a need at the time. This bond is a solid bond with thimbles swaged on the ends. The "Crown" bond, which is a heavy cable, flexible bond made to go under the fish plates, is the latest type of bond shown. Wires for every conceivable electrical purpose are shown. N. H. Van Sicklen, of the Chicago office, is in charge.

Enclosed Resistances.

The construction of the type of resistances shown in the accompanying illustrations, consists briefly in employing a metal shell or casing, within which the resistance is contained in a thin layer of vitreous insulation completely surrounding and hermetically sealing the resistance, which insulation is also held in intimate contact with the inner walls of the metal casing. With this construction an apparatus is provided in which the resistance is not only sealed in a high insulating material, but is also so disposed with reference to the metallic casing as to provide rapid conduction or flux of heat to the metal casing, the outside of which is the dissipating surface.

In perfecting the details of this apparatus one object has been to work out carefully in every detail a construction which will make a resistance good for a number of years, if not too greatly abused. An illustration is the method in fastening the terminal points to the resistance. In the case of each terminal an iron or copper screw is employed to bring the current from the resistance within the iron casing to the terminal point without, which copper or iron screw is securely brazed to the resistance conductor, the brazed joint being sealed within the vitreous insualtion.

A comparatively heavy shell of iron is employed, not only for mechanical strength, but also to provide considerable cross section for the rapid conduction of heat from one part of the plate to the other, so as to keep the temperature quite uniform throughout the surface of the plate, regardless of the steps in circuit.

These plates are made in four sizes, namely, 4 by 8 inches, 5 by 12 inches, 7 by 14 inches and 7 by 21 inches, and are substantially as shown in Fig. 4. When banked together they appear as shown in Figs. 2 and 3, and provide a construction which is comparatively compact, and which admits of free ventilation. When the plates are so banked together for convenience, the terminals are all brought out to a common iron strap on one edge of the plate, where a terminal connector bored for a proper size cable is provided for each terminal of the resistance. This makes the apparatus very easy to wire up where the controller is furnished separate from the resistance. This type of resistance is not only suitable for continuous regulation, but is equally suitable for intermittent and starting service. It is particularly suitable for use in damp locations, such as mines, or where the apparatus is likely to be exposed to the weather, as there is nothing to be affected by dampness, since the only materials which enter into the construction are metal, glass and resistance material combined in one solid mass.

To meet the cases where self-contained switches are desirable, a complete line of these have been devised for different kinds of service in the manufacture of rheostats. Round button contacts have

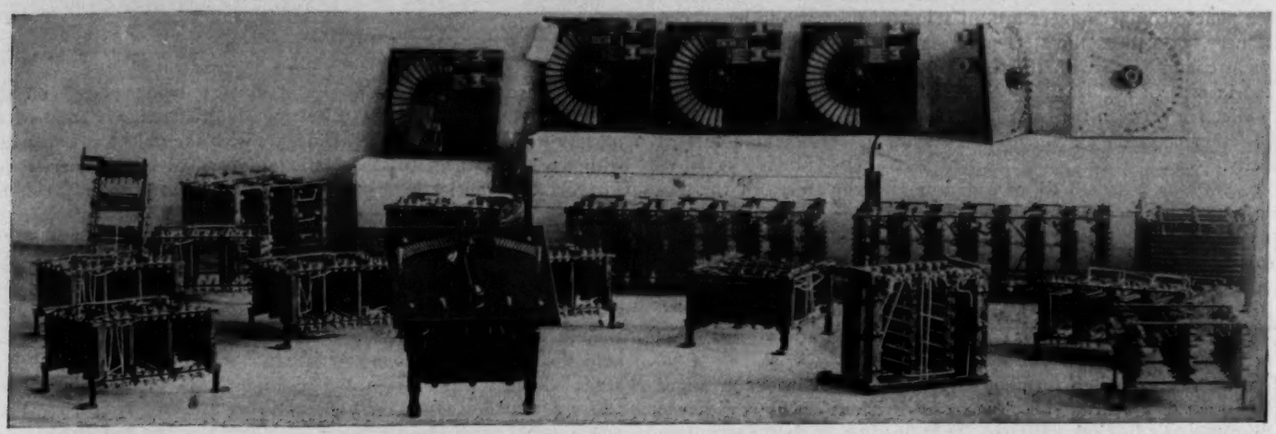
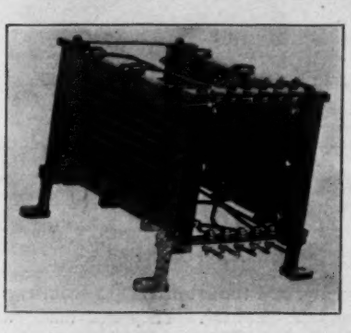
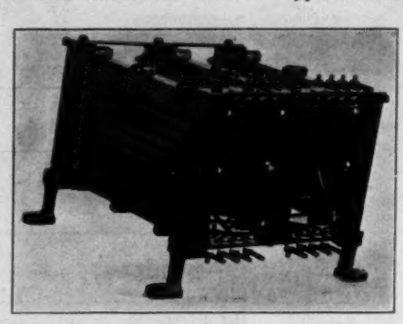


FIG. 1.—GROUP OF ENCLOSED RESISTANCES.





FIGS. 2 AND 3.—BANKS OF ENCLOSED RESISTANCES.

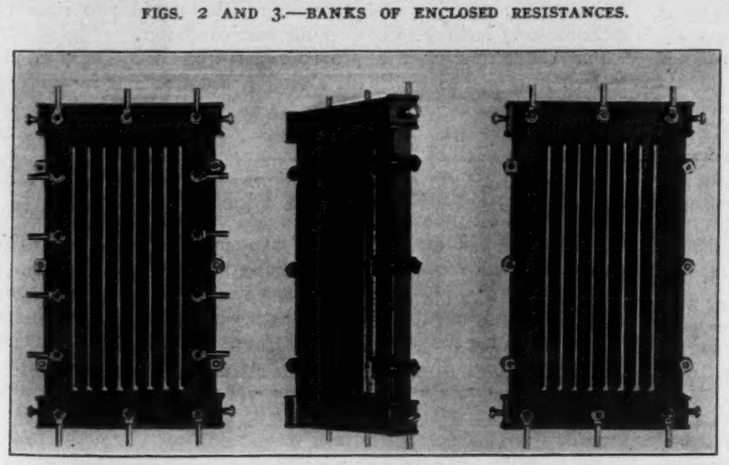


FIG. 4.—ENCLOSED RESISTANCE PLATES.

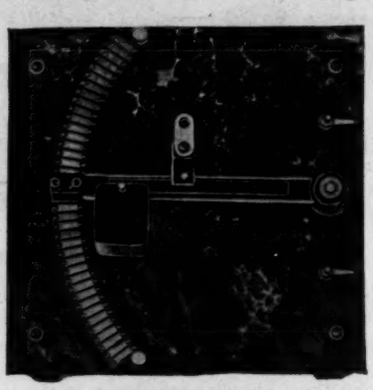


FIG. 5.—ORGAN-MOTOR REGULATOR.

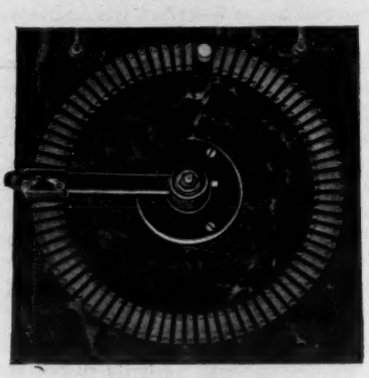


FIG. 6.—FIELD CONTROLLER.

not been employed in the construction of these switches, except for very small current, but sector-shaped pieces employed, such as shown in Figs. 10 and 16.

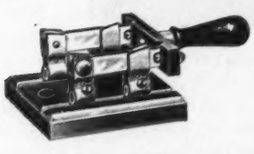
In combination with the sector-shaped pieces, multiple contact fingers are used, not less than two in number, their number depending upon the current capacity of the switch. These multiple contact fingers each consist of a copper block pressed down upon the switch block by steel springs and driven by steel pins, the current being carried from the switch arm to the contact fingers by a small flexible cable. These contact fingers are all standard parts made by special machinery, as well as the steel pins, springs and other parts which work in combination with them, so as to be easily and cheaply replaced in case of accident. By this design the contact can be made very effective between the switch arm and the contact blocks without the friction commonly incident to switches of considerable current capacity.

Fig. 5 shows a switch of an organ-motor regulator. In this apparatus the weight and also the swivel attachment for the cord are adjustable by a set screw entirely independent of each other, and almost the entire length of the switch arm. This in connection with the multiple contact fingers of the construction above described, together with the sector-shaped contact pieces, gives the perfect freedom of movement, which is so essential in an apparatus of this character which has to work automatically.

Fig. 6 shows a switch forming part of a field controller arranged for the back of a board, with 75 steps or divisions of the resistances, and is the type of switch designed for back of board field controllers, as well as other similar apparatus. Fig. 1 is a view of a number of different instruments. The large switches in the background are for mounting on the back of a switchboard controlled by a hand wheel on the front. These switches are used for starting large rotary transformers with about 100 amperes starting torque, and 700 amperes continuous capacity on the short circuit position when the knife blade switches are engaged. Some of the resistances to be used in connection with these switches are shown in the cut. An organ-motor regulator is also shown in the foreground.

The apparatus above described is manufactured by the Carpenter Enclosed Resistance Company, 79 East 130th Street, New York. Mr. C. E. Carpenter, its vice-president, is prominently known in the department of rheostats and resistances, and was, it is believed, the first person to form a company specially devoted to their manufacture, organizing it in the spring of 1892. From that time on, he has devoted himself almost exclusively to the production of rheostats of all descriptions, being thus not only a pioneer inventor, but a steady worker in the line of producing enamel rheostats now used so universally for controlling the fields of dynamos and the speed of small motors.

Slate Base for Baby Knife Switches.



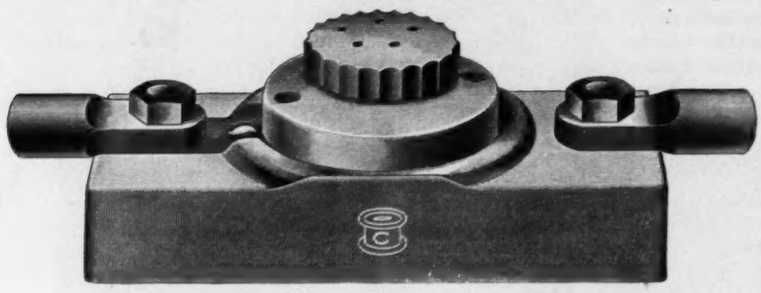
We illustrate herewith a small knife switch generally designated as a "Baby Knife Switch," but which is a radical departure from any construction heretofore used in devices for this purpose. Other small switches have been confined to a porcelain base, and owing to the necessary irregularity of this material, there has been much difficulty in getting the parts uniform and in adjustment. The base of this switch is Monson slate. The holes are drilled in steel templates. The metal contacts are exactly alike, being formed of a bushing of thick metal, one-half of which is fitted exactly to the V-groove in the base, the other half being cylindrical. Around this bushing is formed and riveted the contact proper, and through the two pieces of metal are tapped the thread for the holding-on screw and the wire-binding screw. The hinge joint contact is made secure by having the metal on the contact so formed, as to bring a continuous tension onto the switch blade. All parts are made by automatic machinery, which insures absolute uniformity. The switches are being manufactured and put on the market by the Marshall-Sanders Company, of Boston.

Cluster Fixtures.

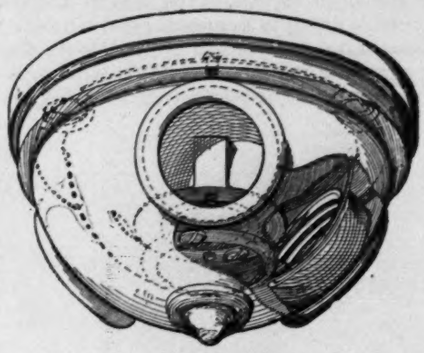
We illustrate herewith a cluster fixture being placed on the market by the Benjamin Electric Manufacturing Company, of 1992 West Van Buren Street, Chicago, with the object of complying with the requirements of the National Board of Fire Underwriters. The clusters consist primarily of a porcelain base upon which are mounted two contact plates each provided with a binding screw and serving like terminals on all the lamps in the cluster. A removable casing (brass or aluminum) insulated from the contacts by porcelain bushings, gives ready access to binding screws. The base is provided with openings for the leading in wires and supporting screws and, in accordance with the Underwriters' rules, all screws which hold the contacts are counter-sunk and cemented in the back. The series clusters differ from the multiple form in that the contact plates are made in sections, each serving for two lamps, the inner and outer ones overlapping each other, but the first and last contacts in the series are necessarily single ones and they carry the binding screws.

These clusters are in two sizes with 2½-inch and 4-inch base. The former is made in two lights only, and the latter ranges from two to six lights, in both Edison and T.-H. base. They are made with enameled tin and polished aluminum reflectors in two sizes (10 inches and 13 inches) to fit over the base of cluster.

For conduit work are provided cast-iron flanges tapped for ½-inch iron pipe to which the cluster is attached and for out-door work, we add a canopy which serves as a watershed and reflector. They are also made in pendant form any length with crowfoot and canopy.



GOODWIN FUSE BLOCK.



CLUSTER FIXTURE.

New Fuse Block.

As we noted at the time in our columns, the Underwriters' National Electrical Association has recently laid down requirements as to fuse blocks, which some years ago would have been considered extremely stringent, the report giving specifications relating to such blocks which bar many of the older types. The fuse block shown in the accompanying illustration has been designed strictly to meet these requirements, and also embodies some specific advances. The block is made in sizes suitable for currents of from 10 to 100 amperes on circuits operated at 125 and 250 volts. For 125 volts the block is fused with the ordinary fuse wire of proper capacity. For 250 volts a special fuse is used, which is claimed to combine the advantages of the best enclosed fuse, besides being placed in a strong porcelain receptacle. A tell-tale button projects through the block and indicates positively whether or not the fuse has blown. This is an entirely mechanical feature and does not expose any of the electrically connected parts.

The block, which is the invention of Mr. W. R. Goodwin, of the Chicago Fuse Wire & Manufacturing Company, measures only 6 inches in length and 2½ inches in width for use on a circuit of 100 amperes at 250 volts.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was marked by rather sharp revulsions of feeling, and by a marked change for the better as soon as some of the humidity that has so long wilted the brokers' collars went West to help the corn. The trouble is there has been too much moisture in New York and too little in Kansas, but things have now been evened up a bit. Even as it was, people were more scared than hurt, for the short corn crop at current quotations is worth about $950,000,000, or $200,000,000 more than last year's big crop at the lower figures, while the wheat crop is a bumper, and all the world wants some. What there is depressing in all that is rather hard to find out, and now that the "big" steel strike has flattened out, Wall Street will probably let prices get somewhere near to real values again. Owing to the heat and the summer holiday dullness, there was not much activity in the market. The range of quotations is given below:

NEW YORK.

	July 20.	July 27.		July 20.	July 27.
American Tel. & Cable	100	—	General Electric	255	255
American Dist. Tel.	34	—	General Carriage	1⅛	—
Brooklyn Rapid Transit.	77¼	77	Hudson River Tel.	120	120
Commercial Cable	—	—	Illinois Elec. Veh. Trans.	⅝	—
Electric Boat	17	16	Metropolitan Street Ry.	168¼	168
Electric Boat pfd.	43	40	N. E. Elec. Veh. Tran.	3	3
Electric Lead Reduc'n	1⅞	—	N. Y. Elec. Veh. Tran.	11½	11½
Electric Vehicle	9	6	N. Y. & N. J. Tel.	170	—
Electric Vehicle pfd.	16	16	Tel. & Tel. Co. of Am.	4	4
			Western Union Tel.	91¾	92¼

BOSTON.

	July 20.	July 27.		July 20.	July 27.
Am. Tel. & Tel.	163	161	Mexican Telephone	2⅜	2½
Edison Electric Light	—	255	New England Telephone	—	134
Erie Telephone	48	48	Westinghouse Elec.	67	68
General Electric pfd.	—	263	Westinghouse Elec. pfd.	*79½	*79½

PHILADELPHIA.

	July 20.	July 27.		July 20.	July 27.
American Railways	39½	40	General Electric Auto.	—	—
Electric Storage Battery.	85	80	Philadelphia Electric	5⅜	5¼
Elec. Storage Batt'y pfd.	88	80	Pa. Electric Vehicle	1	—
Elec. Co. of America	6½	7	Pa. Elec. Veh. pfd.	1	—

CHICAGO.

	July 20.	July 27.		July 20.	July 27.
Chicago Edison	176	176	National Carbon pfd.	86½	86½
Chicago City Ry.	206	206	Northwest Elev. com.	45	44
Chicago Telep. Co.	*275	275	Union Traction	17¾	18
National Carbon	16½	16½	Union Traction pfd.	58	58

*Asked.

WESTERN UNION RUMORS.—Discussing recent rumors of Western Union-Postal Telegraph-Bell Telephone consolidation, the Wall Street News Bureau remarks: A fact in favor of Western Union is that the stock has had only one period of speculative activity in the last four years. Mr. Gould and Mr. Rockefeller made a campaign in the stock some time ago, in which the price ran above par. It is supposed that on the decline since May this interest has recovered a line of stock and is now in a move intended to carry the price higher than it went before. There is the advantage in buying Western Union that if a speculative purchase does not prove profitable the holder has a very safe investment. The story of a consolidation of Western Union with Bell Telephone came from Boston, and was exploited with some diligence. After what has occurred, it would be rash to say there is anything which cannot occur. But the chances at present are certainly against a telephone-telegraph consolidation. It is very likely true that the matter has been discussed as stated, because reports of such discussion would have speculative value, although without result. We think Western Union can be bulled better on its value at present than on combination rumors.

TELEPHONE, TELEGRAPH & CABLE.—It is stated that the directors of the Telephone, Telegraph & Cable Company, of America, will meet early in August to consider the reorganization of the company. It is planned to raise additional capital and actively push the business of the company. President Thomas says: "Our ultimate plan is this: We propose to connect Boston, New York, Albany and Philadelphia and all intermediate cities with our own wires. This will require several years to accomplish, and will probably demand $9,000,000 the first year after we start our campaign and $5,000,000 the second year. We hope some day to have 100,000 subscribers in Greater New York, and this would cost $20,000,000. When these plans are fully consummated, we will connect with the Interstate Telephone Company, which is operating in New Jersey, and also with the Keystone Telephone Company, which controls the independent telephone movement in Philadelphia. Our contracts with these two companies are signed. From Ohio and the West we will be connected by means of the Interocean Telephone Company, which is extending its wires along the Erie and New York Central Railroads. We will connect with this company at Albany. The plans of the independent telephone people are far-reaching and will end in there being two great telephone systems. I do not believe that the Western Union Telegraph Company is seeking control of its rivals, nor do I think it will enter the telephone field. We have not been approached."

CONSOLIDATION AT OMAHA.—The consolidation of the local street railway facilities, water works, electric light plant, gas plant and the street car lines connecting Omaha and Council Bluffs is well under way. The consolidated companies will be known as the Omaha Transportation & Power Company. The stock issue of all the companies involved will be largely increased by the issue of stock of the consolidated company. The Platte River Canal will be constructed and owned by this company, and from this source cheap power will be derived. Water sufficient will be diverted from the Platte River to operate all the consolidated industries. It will be transmitted by wires a distance of 40 miles to Omaha, and distributed throughout the city. Five million dollars will be invested in dams, engines, wires and suburban street railway facilities.

CHICAGO UNION TRACTION.—The Chicago Union Traction Company has held its annual meeting. Last year the company placed $4,000 to the surplus account after paying $150,000 in dividends. This year the dividends have been passed. There will be none until the franchise question is settled. Shareholders are informed that the completion of the Northwestern Elevated Road, and the opening of all stations on its line, has taken many thousands of passengers from the surface lines; that the Consolidated Traction Company purchased from Mr. C. T. Yerkes has added to their losses, and that the surplus has been drawn upon to make good the fixed charges of the company.

EDISON PORTLAND CEMENT.—Edison Portland Cement Company's initial plant has been financed by an underwriting syndicate taking a block of $500,000 preferred stock and some common stock which had been reserved in the treasury. Substantially all of the $9,000,000 common and $1,500,000 of the authorized $2,000,000 preferred is now issued and outstanding. The original unit now to be put in operation, as soon as it can be completed, which it is hoped will be early next year, will have a capacity of at least 1500 bbls. per day, and eventually 4500. The plant is so constructed that by an extension of 30 per cent of the original, a productive capacity of 10,000 bbls. a day is claimed.

TWIN CITY TROLLEY PROSPERITY.—The directors of the Twin City Rapid Transit Company have placed the common stock on a 4 per cent dividend basis, having declared a semi-annual dividend of 2 per cent on the common stock lately out of the earnings for the six months ending June 30, 1901. After the payment of the dividend, there was left a surplus of $34,475 for the six months ended June 30, which compares with a surplus of $30,436 after 1½ per cent was paid on the common stock for the corresponding period in 1900. President Lowry says that the earnings for the year ending Dec. 31, 1901, will show something like 6 per cent earned on the common stock.

UNITED POWER & TRANSPORTATION.—An assessment of $5 a share has been called on the United Power & Transportation Company stock, payable on or before Oct. 1. The present call makes the stock full-paid $25, removing all assessment liabilities. A director says: "We are spending this year nearly $2,000,000 for improvements, extensions and for newly acquired properties, and it is in this direction that the proceeds of the present call will be applied. An offer to lease the Reading Southwestern will be made next week, and we expect it will be accepted."

ENGLISH CAPITAL IN AMERICAN SECURITIES.—The chairman of the London & Westminister Bank, one of the largest institutions of its kind in England, declared at the annual meeting of the shareholders that English capitalists were again heavily investing in American securities. In 1890, he said, of all the advances made upon various securities, 33 per cent were on American. The proportion now, according to the chairman, is 48 per cent.

TELEPHONE CONSOLIDATION.—At Reading, Pa., on July 27, Mr. T. K. Leidy filed articles in amendment of the charter of the Schuylkill Valley Telephone Company. The company seeks to change its name to the Consolidated Telephone Companies, of Pennsylvania, and to increase its capital stock from $400,000 to $4,000,000. The object of increasing its capital is the purchase of a number of companies which are to be a part of the new combination.

DIVIDENDS.—The directors of the Denver City Tramway Company have declared the usual quarterly dividend of 1 per cent, payable Aug. 16. The Hudson River Telephone Company has declared the regular quarterly dividend of 1¼ per cent, payable Aug. 1. The directors of the Telephone Company have decided to expend between $200,000 and $250,000 to put the Troy service in fine modern condition. The Chicago Edison Company has declared the regular quarterly dividend of 2 per cent, payable Aug. 1. Books close July 25 and reopen Aug. 2. The New England Telephone & Telegraph Company has declared a regular quarterly dividend of 1½ per cent, payable Aug. 15. The Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1¾ per cent on its assenting stock, payable Aug. 15.

CENTRAL LONDON UNDERGROUND.—The Central London Underground Railway, otherwise known as the "Tuppenny Tube," has declared a half-yearly dividend at the rate of 4 per cent per annum and carried forward £19,000. The company has £440,100 in 4 per cent preferred shares and an equal amount in common. The line was opened in July, 1900. A dividend of 2 per cent per full share was paid in February.

MOBILE, ALA., CONSOLIDATION.—The Mobile Gas Light & Coke Company and the Electric Lighting Company, of Mobile, have each called meetings for Aug. 21, to consider a consolidation of interests. Plans for the consolidation are said to have been tentatively agreed upon.

BOSTON ELEVATED.—Directors of the Boston Elevated have declared a semi-annual dividend of 3½ per cent. This is an increase from a 4½ per cent to 7 per cent basis. The declaration of this dividend necessitates the division of 1 per cent or $100,000 with the State.

GENERAL ELECTRIC.—There are reports current that the long-delayed General Electric "melon" may be cut early this fall, and that a scrip dividend will be made representing the capital reduction in 1898, when the capitalization was literally cut in two.

THE ELECTRIC COMPANY OF AMERICA reports that the June net earnings of the 13 plants which it is operating show an increase of 23 per cent over those of the corresponding month in 1900.

AMSTERDAM, N. Y., TROLLEYS.—The Amsterdam Street Railway Company has voted to increase its capital stock from $250,000 to $1,000,000.

Commercial Intelligence.

THE WEEK IN TRADE was naturally influenced by the serious condition of the corn crop and by the steel strike; but not so much as the reports from the stock market might indicate, and now that both depressing influences have been minimized by the joint work of God and man, the solid conditions of a very stable prosperity again come into evidence. The demand for iron and steel is remarkably strong, and any lowering of price only brings more buying on a larger scale. As to general conditions, it is noted that retail trade in the West has never been better. Railroad earnings for half of July are 10.3 per cent in excess of last year, and 23.9 per cent over 1899. Bank clearings show a gain at New York of 82.5 per cent from 1900 and 56.4 per cent from 1899; while at leading cities outside New York the gain is 23.2 per cent over 1900 and 16.6 over 1899. The active demand for finished metal products, such as tin plates, iron and steel bars, hoops and sheets, is reducing jobbers' stocks rapidly and causing high premiums, such as $18 on sheets, $20 on tin plate, $5 on hoops, and $2 per ton on bar iron and skelp at Pittsburg, where a heavy business has been booked for structural material. No prices have formally been fixed for steel rails, but some business has been placed for next year at $28. Business failures in the United States for the week were 199, as against 208 last yeek, 183 this week a year ago, 170 in 1899, 189 in 1898 and 259 in 1897.

THE COALZACOALCOS REPAIR SHOPS, of the National Tehauntepec Railway, Mexico, are to be installed with American machine tools, driven by American motors. The Westinghouse Electric & Manufacturing Company has secured the electrical portion of the contract, and the Morgan Engineering Company, of Alliance, Ohio, will build the crane equipment. Milliken Brothers, Bowling Green Building, 7-11 Broadway, hold the original contract for the erection and complete equipment of the Coalzacoalcos shops, but as they are mainly interested in the supply of structural material the machinery end of the contract is being sub-let by them. The order regarding the machine tools has not yet been placed. The Tehauntepec Railroad is being constructed on behalf of the Mexican Government by the British contracting firm of S. Pearson & Son, which is purchasing considerable material, rolling stock, machinery, etc., in this market. The Pearson Company's offices are in the City of Mexico and London.

RUSSIA AND SIBERIA.—Some important contracts have recently been placed in this market through local export houses having connections with the Russian and Siberian trades. While a policy of great secrecy is being pursued as to the exact ultimate destination of the goods ordered, which in the first instance will be shipped to Port Arthur, it is believed that the contracts are placed here principally on behalf of the Chinese Eastern Railway authorities. One commission house alone is reported to have closed contracts within the last month for close on $200,000 worth of various American material, machinery, etc. The Worthington branch of the International Pump Company is understood to have received some large orders for pumping equipments, and Edward J. Etting, of 39 Cortlandt Street, has secured a fair-sized cupola order, which will be turned out by the Whiting Foundry & Machine Company, of Harvey, Ill. Some foundry supplies, including molding machinery, will be supplied by Byram & Co., of Detroit, Mich.

THE CONSUMERS' LIGHT & POWER COMPANY, of Middletown, N. Y., has placed a contract with Westinghouse, Church, Kerr & Co., for two compound vertical engines of 160 horse-power each. The Westinghouse people have also secured orders for all the necessary piping, condensers, heating apparatus, pumping equipment, etc., which will be sub-let by that firm. Two three-phase alternating-current generators of 100 kilowatts, with the requisite exciters for direct connection with same, will be furnished by the General Electric Company. The contract for boilers, stack and smoke flue has been allotted to the Hogan Boiler Works, 79 Broadway. The boilers will be water-tube ones of 150 horse-power each. The Middletown concern is now in the market for arc lamps, wire, poles and general material for line work for a general system of lighting, which it is intended to operate from their new plant.

INCREASE IN CANADIAN TRADE.—From unrevised figures obtained at the Department of Customs, it would appear that the foreign trade of Canada last year amounted to about $394,000,000, or about $13,000,000 more than the previous year, which was by far the largest in the history of the country. There was an increase of about $15,000,000, or 60 per cent, in exports of produce of the mine, and a growth of $2,000,000 in manufactures exported. The exports of produce of the farm, fisheries and forest have been practically stationary. The exports of foreign produce from Canada amounted to $20,379,212. In 1900 they were $21,252,354. Foreign farm produce to the value of $15,820,302 was imported by Canadian routes, while the year previous such imports amounted to $12,101,212. The total imports entered for consumption were $181,225,389; for the year previous they amounted to $180,804,316.

SNOQUALMIE FALLS POWER EXTENSION.—Charles H. Baker, president of the Snoqualmie Falls Power Company, announces that his company has completed plans for the construction of a new power plant at the falls, and the installation of new machinery which will more than double the present capacity of the plant. The company will spend approximately $350,000 on improvements. A new power chamber is to be excavated in the solid rock just north of the present chamber. Three generators of 4000 horse-power each will be installed. They will be operated by impact water-wheels of similar pattern to those now at the station, save that the wheels will be larger. One generator has already been ordered from the East.

MR. HARRY S. STALLKNECHT, of New York City, and his associates have secured franchises which permit of the utilization of water powers in Puerto Rico. There are seven small rivers on the island available for the development of power. The largest is in the vicinity of San Juan, and will show a capacity of 1500 horse-power, while the six others aggregate 6500 horse-power. Projects are now said to be under consideration with a view to the taking advantage of such power for industrial purposes. Mr. Stallknecht's offices are located in the Broad Exchange Building, 26 Broad Street.

MR. H. S. LOUD, managing director of the British Westinghouse Electric & Manufacturing Company, Limited, has just returned from Europe, whither he recently went for the purpose of inspecting the progress made in the construction of the Manchester plant and conferring with the English interests of the company as to the placing of contracts for equipment, etc. Mr. Loud is now in Pittsburg.

MR. F. A. ESTEP, president of the street car supply house of R. D. Nuttall Company, Pittsburg, Pa., sailed last week for Europe on a business trip. While abroad Mr. Estep will establish several additional agencies for the sale of his company's specialties in various parts of Continental Europe. The Nuttall Company is now filling fair-sized contracts for Great Britain, the Netherlands and Italy.

McCARTHY BROTHERS & FORD, of Buffalo, N. Y., have obtained an order for marbleized switchboards, which are to be shipped to the Singapore branch of the American electrical engineering and contracting firm of Bagnall & Hilles.

EXPORTS OF ELECTRICAL MATERIAL.—The following are the exports of electrical material from the port of New York for the week ended July 25: Antwerp—202 packages electrical material, $7,464; 28 packages electrical machinery, $772. Argentine Republic —1 package electrical machinery, $67; 3 cases electric machinery, $557. Amsterdam—1 motor vehicle, $850; 2 cases electrical material, $40. British Possessions in Africa—1 package electrical material, $25. British East Indies—59 cases electrical material, $2,213; 150 cases electrical machinery, $3,249. Brazil—61 packages electrical material, $2,140. Bremen—1 package electrical material, $10. British West Indies—38 packages electrical material, $2,031; 1 case electrical machinery, $729. Cuba—9 cases electrical machinery, $1,265; 211 packages electrical material, $9,293. Central America—11 cases electrical material, $310. Cologne—6 packages electrical machinery, $400. Danish West Indies—1 package electrical material, $10. Dutch West Indies—4 packages electrical material, $70. Ecuador—53 packages electrical material, $1,140. Glasgow—19 packages electrical machinery, $2,900; 3 cases electrical material, $88. Hamburg—1 package electrical machinery, $18; 31 packages electrical material, $1,626. Havre—20 packages electrical material, $1,250; 6 cases electrical machinery, $231. London—202 cases electrical machinery, $9,496; 115 cases electrical material, $4,047. Liverpool—22 cases electrical machinery, $3,040; 54 cases electrical material, $2,004; 2 cases motor vehicles, $1,800. Mulheim—1 case electrical machinery, $125. Mexico—10 packages electrical material, $2,356; 1 package electrical machinery, $52. Manchester—17 cases electrical machinery, $1,643. Peru—1 case electrical material, $13; 88 cases electrical machinery, $7,000. Newcastle—43 cases electrical machinery, $5,250. Rotterdam—1 case electrical material, $100. Southampton—98 cases electrical machinery, $14,742. Santander—1 case electros, $6. St. Petersburg—2 packages electrical material, $132. U. S. Colombia—2 cases electrical material, $75; 2 cases electrical machinery, $172. Venezuela—35 cases electrical material, $906; 7 cases electrical machinery, $172. Walsall—11 packages electrical material, $520.

THE UNITED STATES & AUSTRALASIAN SHIPPING COMPANY'S steamship, "Knight of St. George,' is scheduled to sail July 29 for Sydney, with one of the most valuable cargoes ever forwarded from this country to the Antipodes. The vessel will carry not far short of 11,000 tons, which will represent an aggregate value of nearly $1,500,000. The principal item in the cargo will be electrical machinery intended to be installed in the central generating station of the Sydney City & Suburban Tramways. The Allis-Chalmers Company have forwarded from their Milwaukee plant a 32 by 64 by 60 vertical cross-compound engine, which will develop a nominal capacity of 1500 horse-power. This machine has been carried by rail from the West on 13 cars, representing a weight of almost 225 tons. The bed plate alone weighs nearly 50,000 lbs. This is the first of the three similar Allis engines ordered for installation in the Sydney plant. The Harrisburg Foundry & Machine Company, of Harrisburg, Pa., whose New York offices are in the Mail and Express Building, is forwarding a 9 and 16½ by 12 R. H. Standard tandem-compound engine, which is to be direct connected to a 100-kw generator to be furnished by the General Electric Company. The pumping equipment is being supplied by the Worthington branch of the International Pump Company. Another Allis engine is to be shipped, according to present arrangements, in September, while the last machine is to be forwarded in October. The "Knight of St. George" will also carry over $100,000 worth of electrical equipment built by the General Electric Company, which is under contract to carry out the complete installation of the Australian plant. The contract is worth almost $800,000. There will be three 1500-kw G. E. generators. The piping, etc., contract, said to be valued valued in the neighborhood of $50,000, has been sublet to the Crane Company, of Chicago. The Sydney power house is at present installed with four 850-kw generators supplied by the General Electric Company. The engines are horizontal ones, built at the Allis works. When completed the new Sydney plant will, it is said, be one of the most perfectly equipped power installations in any country.

TELPHERAGE IN CUBA.—A very interesting application of the telpherage system, for the overhead transportation of materials, is about to be made in the vicinity of Havana, Cuba. The United Telpherage Company, of 20 Broad Street, New York, recently secured the contract for carrying limestone from a quarry to a cement works. The circuit is about 1½ miles, up a slight grade, and across a small river. Until a few weeks ago the limestone had been brought to the works on a narrow-gauge surface tramway, which crossed the stream on a bridge near the works. The river rose rapidly one night, as rivers in tropical countries often do, the bridge was washed out to sea, and all connections with the quarry cut off. The company immediately prepared to build a new bridge, but before starting on the work decided to investigate the telpherage system. A representative of the United Telpherage Company, who happened to be in Cuba at the time, had very little trouble in convincing the manager of the works that any future trouble from floods would be avoided by the use of the overhead electric telpher line, which would not only be much cheaper and more economical in operation than any surface tramway, but which could also be installed for a sum less than the cost of a new bridge. A double line is to be built with a loop at each end, so that the telphers can run continuously. At present it is intended to operate only three telphers, running at an average speed of 12 miles per hour; but later on the number of telphers will be increased until 125 tons will be handled in 10 hours. By building a double line, using one track cable for carrying the loaded telphers to the works and the other for returning the empty telphers to the quarry, the capacity of the line is limited only by the number of telphers, so that as the work increases it is necessary simply to add more telphers. This case is typical of much of the work opening up for telpherage in the tropics, where it is often impossible and some times undesirable to lay tracks, and yet where the ordinary roads or bridges are not adequate to the duty. This would appear from the inquiries addressed to the United Telpherage Company, to be particularly true of coffee walks, fruit plantations, etc.

ORDERS FOR ELECTRIC CRANES.—The Case Manufacturing Company, Columbus, Ohio, report the following contracts for electric cranes, etc.: Lake Superior Power Company, Sault Ste Marie, Ont., one 15-ton, 69-ft. span electric traveling crane; John H. McGow & Co., Cincinnati, Ohio, one 10-ton, 45-ft. span electric crane; St. Louis Transit Company, St. Louis, Mo., one 15-ton, 40-ft. span electric crane; J. H. Mann, Lewiston, Pa., one jib crane, 5 tons capacity; Block-Pollak Iron Company, Cincinnati, Ohio, one 14-ton, 35-ft. span electric traveling crane; Best Manufacturing Company, Pittsburg, Pa., two 5-ton electric traveling cranes; Hoeffinghoeff & Lane Foundry Company, Cincinnati, Ohio, two 7½-ton hand-power jib cranes; Erie City Iron Works, Erie, Pa., one 6-ton jib crane; U. Baird Machinery Company, Pittsburg, Pa., one 15-ton, 38-ft. span crane; Wellman-Seaver Engineering Company, Cleveland, Ohio, for three trolleys to be used on the 75-ton Holden-Gantry crane; St. Louis Iron & Steel Foundry Company, St. Louis, Mo., one 15-ton, 38-ft. span electric traveling crane; Humphrys Manufacturing Company, Mansfield, Ohio, one 15-ton, 49-ft. span electric traveling crane.

TRADE WITH JAPAN.—The remarkable growth in the exports of the United States to Japan is shown by some figures just compiled by the Treasury Bureau of Statistics. The imports from the United States have grown from 6,000,000 yen in 1893 to over 60,000,000 yen in 1900, while the United States, which stood sixth in rank in the list of countries from which Japan drew her imports in 1893, is now second in the list, being only exceeded by Great Britain. In 1900 the list stood: From the United Kingdom, 71,638,219 yen; from the United States, 62,761,196 yen; China, 29,960,740 yen; Germany, 29,199,695 yen; British India, 23,516,350 yen; Hong Kong, 10,659,855 yen; France, 8,095,819 yen; and Belgium, 1,949,253 yen. In 1893 the United States supplied 7 per cent, Germany 9 per cent, and the United Kingdom 32 per cent of the total imports into Japan; in 1900, the United States supplied 21 per cent, Germany 10 per cent and the United Kingdom 25 per cent. The item of machinery has increased from $104,954 in 1893 to not less than $1,061,224 in 1900.

STOCKHOLM, SWEDEN.—Graham Brothers, said to be one of the largest handlers of machinery in Northern Europe, are at present placing some fair-sized orders for American engines, boilers and a general line of American labor-saving devices. Westinghouse, Church, Kerr & Co., of New York City, have secured an order calling for one 330-hp compound vertical engine, one 100-hp compound vertical, and a simple vertical machine of 30 horse-power. These engines are intended for installation in electric power and light plants in the Swedish capital.

ORDERS FOR BALL ENGINES.—Mr. Duncan Bond, Denver representative of the Ball Engine Company, Erie, Pa., recently furnished the Iowa Gold Mining & Milling Company, Silverton, Colo., with a 100-hp self-oiling engine for electric service. Messrs. Dravo, Doyle & Co., Pittsburg representatives of the Ball Engine Co., Erie, Pa., have recently installed in the Washington County (Pa.) Courthouse, for the electric plant, two 80-hp self-oiling engines, direct connected to Crocker-Wheeler generators.

THE MARINE ENGINE & MACHINE COMPANY, of 80 Broadway, N. Y., reports that in addition to its contract for the Washington Monument, it has recently secured two additional government contracts, and is at present installing its electric elevators under five contracts, also in New York City. There is a large and growing demand for electric elevators all over the country.

PORTUGAL.—Barber & Co.'s steamer "Dona Maria" is scheduled to sail for Spain with some 700 tons of equipment, etc., for the Lisbon Tramways. The cargo included 10 cars, built by the St. Louis Car Company, of St. Louis, Mo., and 25 miles of trolley wire supplied through the Morris Electric Company, of New York City.

General News.

ENGLISH NOTES.

LONDON OFFICE OF ELECTRICAL WORLD AND ENGINEER,
July 23, 1901.

WESTINGHOUSE IN ENGLAND.—On visiting Manchester and approaching the suburbs of the city where Trafford Park is situated, from long distances can be seen looming up the enormous buildings which the British Westinghouse Electric & Manufacturing Company are erecting there at an expense of considerably over a million pounds. The work is now being rapidly pushed in the hands of James Stewart, who, while Scotch, has got American methods. He is using all his abilities to push the work to completion. About 2600 men are engaged on the work, and every device for the saving of labor has been adopted. Needless to say, the building is entirely of steel with brick walls, and the whole of the steel work has been supplied by Dorman & Long, of Middlesborough, who had the contract for the steel work.

BALFOUR ON TROLLEYS.—Speaking at the extension of the London United Tramways a week or two ago, Hon. A. J. Balfour, Conservative leader in the House of Commons, made a notable speech, in which he said that the question of congestion in the centers of great populous areas might always be stated in terms of time and cost. There would be no congestion if we could all move at no expense with an indefinite speed from the outskirts to the center of London. He is a great believer in the providing of facilities for reaching the suburbs of the city from the great working portions of the metropolis, and he considered that the system of the London United Electric Tramways was no small contribution to the civilization and happiness of mankind. The chairman of the company referred to the progress which the company had made and to the tremendous opposition which they had met with, and stated that now at the end of five years they had 40 miles of route authorized, and he hoped in the near future they would have authority for an extension of other 54 miles.

LIGHT FOR CENTRAL AFRICA.—It is stated that Heriot-Watt College, Edinburgh, through Professor Bailey and Mr. A. S. Chalmers, one of its students, is introducing to the very heart of Central Africa an electric plant for lighting and power. At present kerosene oil alone supplies light to the great industrial college and Scottish mission stations around the head of Lake Nyassa. The freight raises the cost of sixty cents' worth of the paraffin oil to $7. The light thus supplied to the native students and purchased by the Europeans at present represents the interest of $20,000. This sum Mr. James Stevenson, of Glasgow, and others are supplying to send out Mr. A. S. Chalmers in a month or two with the electric plant. There is a fine water-power on the high uplands above Florence Bay to generate electricity enough to supply 600 lamps of 6-candle power each and to give power for motors to drive a brick-making machine, a flour mill, a pneumatic hammer, an iron-turning lathe, wood-working machines, and the printing press.

AMERICAN ENGINES IN ENGLAND.—Soon after the opening of the Glasgow Tramways the local newspapers and some of the London technical papers appeared to take delight in recording the fact that the Allis engines in the Pinkston power house would not start work. On investigation, it turned out to be quite true, that the main bearings of these engines had heated and had to be renewed, and that accordingly there had been a few weeks' delay. The Allis engineers claimed that the engines had been put into actual service too soon and without any of the usual trials and gradual increase of load. It is gratifying now, however, to find from a recent report by the consulting engineer that all of these troubles have been got over, and that the engines are now doing regular and good work. The Musgrave engines are also now in service, and, while they also heated somewhat on the start, they are now doing good work also. In the meantime the report goes on to say that the Stewart engines, which have been in constant service from the first, though not under full load, are to undergo certain alterations, as their governing properties have not satisfied the engineers. The coal handling devices have been tested and found satisfactory, as well as the economizers and the condenser and auxiliary plant.

BRITISH ELECTRIC TRACTION COMPANY.—Sir Charles Rivers Wilson, at a recent meeting of the British Electric Traction Company, of which he is chairman, after reviewing the prosperous financial position of the company, said that 45 miles of new tramways had been opened since the interim report was presented last November, the capital outlay on which was £128,000, which was unproductive in this year's balance sheet. The work carried out since the last meeting amounted to 60 miles of new electric tramways. They had also obtained acts of Parliament and orders which had been confirmed for South Staffordshire 7 miles, Morley and district 8¾ miles, Spen Valley Light Railway 19 miles, Worcester district 4¾ miles, and others, covering a mileage of 80 miles, which would be proceeded with as soon as circumstances would allow. Besides these there were light railways for Kidderminster, the Potteries and Wigan, making a total of 27 miles. Altogether there were now in active operation 238 miles of trams, of which 118 were electric, 56 steam and 64 horse, many of the latter being in course of conversion to electricity, and this did not include 75 miles covered with omnibuses. Last year they took in penny and two-penny fares £600,000, as against £400,000 for the preceding year, and carried over 100,000,000 passengers.

TEARING UP LONDON STREETS.—New arrangements are being completed for a wholesale upheaval of the streets again this year. Last year the whole of the Victoria embankment was open from end to end and traffic completely blocked, and it is now stated that it is again to be opened for the new River Company. It is also stated that the Post Office authorities, who are still working on their telephone system, are going to tear up Shaftesbury Avenue, Rosebery Avenue, and, most important of all, Queen Victoria Street, from Blackfriar's Bridge to the Mansion House. In addition to this the County of London and Brush Provincial Electric Lighting Company, the London Electric Supply Corporation, the Metropolitan Electric Supply Company and others intend to tear up Holborn, Holborn Viaduct, Blackfriar's Road, Trafalgar Square, The Strand, Northumberland Avenue and other important avenues of communication. This does not represent the complete list, but it will show how the citizens of London will again have to suffer from this form of street obstruction and what a boon to London it would have been had the main thoroughfares been equipped years ago throughout with a large underground tunnel such as does exist under a number of streets, and which is always put down under any new thoroughfare which may be built.

VISIT TO BABCOCK-WILCOX WORKS.—On the occasion of the meeting of the members of the Incorporated Municipal Electrical Association at Glasgow a number of very pleasant entertainments were provided, both in Glasgow and in Edinburgh. One of these was a visit which the members made to the works of the Babcock & Wilcox boiler works at South Renfrew, and the extremely hospitable manner in which this enterprising firm afterward entertained the members and their friends by a trip down the river Clyde at the invitation of James Rosenthal. A special train was provided from Glasgow to South Renfrew Station, and about an hour and a half was pleasantly occupied in an examination of their extensive works. The electrical engineers had an opportunity of seeing the commencement of a fine electrical power station, from which it is intended to further increase the distribution of electric power throughout the whole of these works. The firm intends to discard the use of small steam engines in various departments throughout, and from what was stated it is anticipated that this will be one of the most complete and up-to-date electric power plants for factory driving in existence. To go into all that was seen in detail would occupy pages. The works cover the best portion of 34 acres of ground, and are capable of an output of 300,000 horse-power of marine boilers per annum and an output of four boilers for stationary purposes a day, besides an immense quantity of steam pipes, mechanical stokers, superheaters and the various specialties for the generation of steam, in which this firm is so eminent.

BRITISH ENGINEERS IN BERLIN.—The members of the British Institution of Electrical Engineers visiting Berlin were entertained by the two big firms, the Allgemeine Elektricitaets Werke and Messrs. Siemens & Halske. Mr. Rathenau, who presided, after referring to the large programme which had been provided for the guests to enable them to study in detail the various branches of the manufactories, said: "We consider this a debt of gratitude which we owe to you. The electro-technical industry is nothing more nor less than the child of mechanical engineering, which we have learnt in your country—in your manufactories in London, Manchester, Leeds, Birmingham, Glasgow and other industrial centres of your country, and our young engineers considered their career finished only when they had studied the large works and excellent arrangements of such firms as Messrs. John Penn & Son, Messrs. Neilson, Reid & Company, Sir William Armstrong, Whitworth & Company, Messrs. Harland & Wolff and others. We have to thank your countrymen for the pioneer work in connection with locomotive and ship construction, tool, spinning, weaving and other machinery too numerous to mention, and if you see the exertions of Germany in the branches above stated, and the men of science who have framed and spread their theories after having got their initiative from England, their large works with hundreds and thousands of workmen, then you will do our countrymen the justice to admit that the masters may well be proud of their scholars. Notwithstanding this competition, your factories have not ceased to perform great things, and owing to this competition especially, they have been enabled to rule the markets of the world. In the same way the German electro-technical industry is following in their footsteps, in opposition to those countries which bar their doors against our wares by high protective duties. Having these principles and interests in common, we should stand side by side, and unite more closely in furthering our common aims and support each other in our trade."

VISIT TO THE BRUSH WORKS.—On the occasion of the meeting of the Incorporated Association of Municipal and County Engineers, which was held during the past month at Leicester, the Brush Electrical Engineering Company, Ltd., took the opportunity of inviting the members to visit their extensive works at Loughborough. From 200 to 300 visitors arrived there about noon. A start was made from the general offices, and, passing through the heavy-tool shop and erecting shop, the first inspection was made of their traction truck and car under frame shop. This is rather a new department for the Brush Company, and proved to be very interesting, as they are the first in England to go in for the complete manufacture of car trucks. After completing an inspection of the works a most elaborate luncheon was served in one of the new buildings, which has not as yet been equipped with machinery, Lord Vaux, of Harrowden, presiding, who, after the usual loyal toasts, proposed the Incorporated Association of Municipal and County Engineers, to which E. George Mawbey, the president of the association, replied. Mr. Mawbey then proposed the Brush Electrical Engineering Company, Ltd., to which R. P. Sellon replied. In the course of his remarks Mr. Sellon, while acknowledging the developments of electrical apparatus in America and Germany, stated that the Brush Company was not ashamed to adopt the best processes and best ideas of both countries, and that they prided themselves that they now had a factory equal to any in the world and combining the best practices of Great Britain, America and Germany. They had no hesitation in selecting that which was best in the methods and processes of their competitors, and had added them to their own traditional reputation for good and solid work. Some of the contracts now being executed by the company are the following: Leicester Corporation: Two 100-kw steam inductor alternators, to be direct-coupled to horizontal slow-speed engines, supplied by Hick, Hargreaves & Company, running at 100 r. p. m., with a periodicity of 50 per second. These are the largest machines of this particular class yet built in Great Britain; also for the same corporation, a high-tension main switchboard, which, when complete, will be one of the largest and finest examples of switchboard work built. Electric Lighting & Traction Company, of Australia, Ltd., of Melbourne: Two 500-kw steam inductors, constructed for single-phase working, each provided with its own condenser, air pump and direct-coupled exciter. The sets are to run at 250 r. p. m. and at a periodicity of 50 per second. One set is now delivered at Melbourne, and the second one is ready for shipment. Electrical Power Distribution Company and the British Electric Traction Company: Twenty-six sets of steam dynamos of various sizes. Each set comprises universal engine and direct-current traction dynamo. Pietermaritzburg Corporation: Two 120-kw steam dynamos for operating the tramways in that town.

THE TELEPHONE.

SACRAMENTO, CALIF.—The Pacific States Telephone & Telegraph Company has about 2500 telephones connected with its exchange in Sacramento.

SAN FRANCISCO, CALIF.—The Pacific States Telephone & Telegraph Company recently filed a protest before the San Francisco Board of Equalization. The assessment is $2,939,470, an increase on plant and franchise of $750,000.

CHICAGO, ILL.—At a meeting of the officers and directors of the Illinois Manufacturers' Association last week it was decided unanimously to at once bring legal proceedings to compel the Chicago Telephone Company to reduce its maximum charge for instruments from $175 to $125 a year, the rate fixed in the franchise under which the company is operating. The Illinois Manufacturers' Association has more than 500 members in Chicago, all of whom use telephones, and some of whom use from ten to fifty.

LAFAYETTE, IND.—The Mutual Telephone Association of Indiana held its annual meeting here on July 29. The delegates and visitors were entertained by the Lafayette Telephone Company and the Sterling Electric Company.

WABASH, IND.—Serious damage was done to the telephone system by the recent storm. The services of the Home Telephone Company were practically suspended for a time. At Portland, in an adjoining county, the storm caused the United Telephone Company severe loss in instruments.

INDIANAPOLIS, IND.—Despite the heat that has prevailed during the past week very satisfactory progress was made in telephone construction. It is acknowledged that the independent telephone movement has progressed more rapidly in Indiana than any other State, with the possible exception of Ohio. The assessment of the telephone property of the State by the State Tax Board was made last week. It was shown that the companies have made large additions, both to their pole and wire mileage; that companies have multiplied and telephone property has improved generally, and that there has been a gratifying increase in the earnings of the companies. The Board has not yet announced the rate of taxation.

LOUISVILLE, KY.—A restraining order has been granted in the suit of the Louisville Electric Light Company for an injunction to prevent the Cumberland Telephone Company from erecting poles or wires within twelve inches of the former's wires in a certain section of the city.

KINEO, MAINE.—The Moosehead Telephone & Telegraph Company closed a contract with the New England Telephone & Telegraph Company. The New England company will extend its line from Monson to Greenville, and the Moosehead company will build to Greenville from Kineo, via Spencer and Lily Bay.

BENZONIA, MICH.—The Benzie County Telephone Company is extending its line to Manistee. The company has had a rapid growth, having 180 local subscribers, and complete systems have been installed at Frankfort, Benzonia, Honor, Thompsonville, South Frankfort, Bear Lake and Beulah; also toll stations at Homestead, Arcadia, Eden and Onekama. The line connects with the Independent State line at Thompsonville. From a small beginning of a few hundred dollars the company has grown to a capital of over $10,000.

PLATTSBURG, MO.—The Plattsburg Telephone Company, of Plattsburg, Mo., with a capital stock of $10,000, was incorporated July 20 by J. C. Atcheson, F. R. Allen, E. E. Bowlen and others.

RALEIGH, N. C.—The Merchants' Association, in view of the fact that there are three telephone systems in the city, has passed a resolution by which each member agrees to have the Raleigh telephone put in, whenever having a telephone installed; also that the telephone committee be instructed to give notice of this action to the other companies, who have long distance lines with whom the Raleigh Company may be able to connect, and request them to effect such connection, if practicable.

TROY, N. Y.—The Troy Telephone & Telegraph Company is placing its wires underground in this city.

BUFFALO, N. Y.—The control of the Independent Telephone Company at Gowanda, N. Y., has been acquired by E. C. Fisher, of Gowanda, and will hereafter be operated under a license from the New York & Pennsylvania Telephone & Telegraph Company, a Bell concern. The present telephones will be substituted by Bell telephones. This closes out all the independent lines entering at Gowanda and heretofore operated in connection with the Gowanda exchange, reaching points in every direction.

LONG ISLAND, N. Y.—Justice Garret J. Garretson of the New York Supreme Court has granted a writ of peremptory mandamus directing Commissioner Henry S. Kearney of the Department of Public Buildings, Lighting, and Supplies to grant to the Seaboard Telegraph & Telephone Company a permit to repair its poles and wires on its line in Queens Borough between Rockaway Beach, Arverne, Far Rockaway, Inwood, Springfield, and Jamaica to East New York. The Seaboard Company two years ago made application, but the permit was refused by Deputy Commissioner Fowler of Queens, on the ground that the line of that company was paralleled by the line of the New York and New Jersey Telephone Company, and that it is contrary to the provisions of the charter of Greater New York to permit one line to be built parallel to another existing line. He has now been overruled.

COLUMBUS, OHIO.—The Perry Telephone Company, of New Lexington, has been incorporated; capital stock, $25,000.

HARRISBURG, PA.—The Northern Pennsylvania Telephone Company, of Wellsboro, has been incorporated; capital, $12,500.

JACKSON, TENN.—A franchise has been granted the Jackson Home Telephone Company.

KNOXVILLE, TENN.—The Cumberland Telephone & Telegraph Company will spend $100,000 in extending its system from Knoxville and East Tennessee to Kentucky.

MEMPHIS, TENN.—The City Council of Jackson, Tenn., has granted a franchise to an independent telephone company, which will co-operate with the Memphis independents in the long distance arrangements.

DOVER, TENN.—Luke Walker has extended his telephone line from Dover to Tobaccoport. It will be completed to Canton, Ky., in a few days. The People's Telephone Company is now building a line from Cumberland City to Big Rock, by the way of Fedora.

AUSTIN, TEX.—The San Angelo Telephone Company, of San Antonio, has been chartered; capital stock, $80,000. Incorporators: J. Y. Pust, J. W. Sims and L. Pust.

SAN ANTONIO, TEXAS.—The Alpine-Terlinger Telephone Company, of Alpine, capital stock $1,000, has been incorporated by A. M. Turney, R. L. Neville and J. C. Bird.

VERNON, TEXAS.—A company has been organized here to build a telephone line from this place to Quanah and Crowell, Texas, and Altus and Enid, Okla. Work will be begun at once.

VERNON, TEXAS.—The Vernon Telephone Company has purchased the Vernon electric light plant and consolidated the two systems under the name of the Vernon Light & Power Company.

FORT WORTH, TEX.—Representatives of seventeen independent telephone companies and exchanges in Texas, Indian Territory and Oklahoma met here on July 17, and formed a permanent organization. The convention decided that all independent telephone exchange companies within the territory mentioned were eligible to membership. The telephone situation in Texas, Oklahoma, Indian Territory and extensions to the stock ranch regions were fully discussed.

RICHMOND, VA.—President J. R. Kemper, of the Virginia Long Distance Telephone Company, is quoted as saying that the reported absorption of the Louisa Telephone Company by the Bell will be to improve his company's system and make it more valuable to local interests.

TACOMA, WASH.—E. A. Seeley has been granted a franchise for an independent telephone system in Tacoma.

OSHKOSH, WIS.—The Fond du Lac Street Railway & Light Company is installing a telephone system in connection with its lines.

ELECTRIC LIGHT AND POWER.

SAN FRANCISCO, CALIF.—The members of the Sierra Club have placed themselves on record as being opposed to the installation of an electric light plant in the Yosemite Valley. A communication has been sent by the club to the Yosemite Commissioners as a result of a recent meeting in the valley, and the protest will be discussed by the commission.

LOS ANGELES, CALIF.—The Equitable Gas & Electric Company has filed articles of incorporation, with a capital of $1,000,000. The directors are Abbot Kinney, S. A. W. Carver, W. J. Washburn, John D. Pope, W. T. Botsford, J. A. Winans and Warren Gillelen. The new company is to absorb the East Side Lighting Company, of which it has already acquired control.

REDDING, CALIF.—The plant and business of the Redding Water Company and Redding Light Company are now owned by the Keswick Electric Power Company, which is interested in a large power plant on Mill Seat Creek, near Shingleton. Two months ago the local companies, of which Francis Smith was president, agreed to sell for $60,000. The Keswick Power Company paid $1,500 and has now paid the balance of $58,500. The new owners will enlarge the whole water and light system, giving the town an adequate supply. The Shingleton plant will be ready with the power by September 1.

AUGUSTA, GA.—President Orr, of the Orr Cotton mills, has awarded the contract for the electric power and machinery to run 100 new looms and 1100 new spindles.

ATLANTA, GA.—Atlanta, says the *Constitution*, of that city, is soon to have a new industry, involving an outlay of Northern and local capital to the extent of $1,000,000, which will practically revolutionize manufacturing conditions. It is the harnessing of the Chattahoochie River at a point about four miles from Bolton by means of a dam with a 40-foot fall, and the erection of a splendid plant which will supply the manufacturers of Atlanta with electricity up to 20,000 horse-power.

CHICAGO, ILL.—The right of way of the Illinois Central Railroad in Chicago, and as far south as Matteson, Ill., will soon be lighted at night by a large electric plant just completed at the foot of Twenty-seventh Street, which will furnish power for illuminating all the tracks, stations, and yards for nearly thirty miles.

TIPTON, IND.—The construction of a new electric light plant, to cost $35,000, is under way here. The plant is to be in operation October 1.

NEW ...BANY, IND.—The first church in this city to install electric fans for the comfort of its congregation so greatly increased the attendance that other churches are providing fans also.

LOUISVILLE, KY.—The Vanceburg Electric Light Company has increased its capital stock and reorganized with G. W. Stamper, president.

PORT DEPOSIT, LA.—The Port Deposit Electric Light Company will reorganize for the purpose of extension and improvement. R. E. McClenahan, W. W. Hopkins and D. George Wilson are among the incorporators.

ELLICOTT CITY, MD.—The Council has awarded the contract for supplying the town with lights to the Patapsco Electric Manufacturing Company.

CAMBRIDGE, MASS.—The plant of the Cambridge Electric Light Company was recently damaged by fire.

ST. LOUIS, MO.—Bids for lighting the city institutions and public buildings for a term of one year from next September were opened by the Board of Public Improvements, July 22. For lighting the buildings south of Washington Avenue, the lowest proposal was submitted by the Missouri-Edison Company, which offered to do the illuminating required for 6 cents per 1000 watt hours. The Laclede Company presented the lowest figures for the lighting north of Washington Avenue, its bid being 8 cents per 1000 watt hours. For the present municipal building lighting the city is paying these companies 12 cents and 13 cents, respectively, per 1000 hours.

BUTTE, MONT.—The Butte Electric & Power Company has been incorporated with a capital of $2,500,000.

RALEIGH, N. C.—The Board of Aldermen has authorized the issuance of $7,000 electric light bonds.

TYRON, N. C.—The town will issue $25,000 of bonds for the construction of a water works system, electric light plant, etc.

TRENTON, N. J.—The Citizens' Light & Power Company has been incorporated, with an authorized capital of $1,500,000. Incorporators: Wm. A. Jones, Melville A. Carpenter and Jos. B. Short, all of Newark, N. J.

BERNARDSVILLE, N. J.—The Bernards Light, Heat & Power Company has been incorporated; capital, $100,000. Incorporators: Grant B. Schley, C. Ledyard Blair, John A. Dryden.

NEWARK, N. J.—Articles incorporating the People's Light & Power Company have been recorded. The authorized capital stock is $1,500,000, and the incorporators are William A. Jones, Joseph B. Short and Melville A. Carpenter.

NEWARK, N. J.—The National Electric Light, Heat & Power Company has been incorporated, with a capital of $200,000. John E. Helm, of Newark, Frederick C. Fischer, of Newark, and William Pelzer, of New York, are the incorporators.

JERSEY CITY, N. J.—The Gould's Rifts Power Company has been incorporated in Trenton, to build a dam across the Delaware River for the generation of electric power. The incorporators are E. C. Hill, Harry Hill and Thomas C. Hill. The capital stock of the company is $100,000.

HEMPSTEAD, L. I.—The village trustees are negotiating with the Roslyn Light & Power Company for an estimate to light with electricity the streets of Hempstead.

CENTRALIA, N. Y.—The Centralia Electric & Power Company, capitalized at $10,000, has been incorporated by Theodore Hass, Herman Hass and Theodore Hass, Sr.

PORT JERVIS, N. Y.—The four local electric and gas plants have been consolidated under one management, with the title of the Port Jervis Electric Light, Power & Gas Company. A new directorate has been formed, and the officers are: R. H. Beach, of New York City, president; C. R. Horn, of New York, secretary and treasurer, and R. S. Weaver, general manager. The syndicate intends to increase the trolley service there and construct fifteen miles of road to summer resorts at Milford, Sparrowbush and Huguenot. The other plants will be developed for manufacturing, lighting, and fuel purposes. The properties are the Deer Park Electric Light Company, Port Jervis Electric Street Railway, Port Jervis Electric Light & Power Company, and the Port Jervis Gas Light Company.

ZANESVILLE, OHIO.—A telegram from Zanesville, Ohio, of July 14 says: "Zanesville is entirely in darkness to-night as a result of the visitation of June bugs in countless numbers. Electric light globes are filled and the lights are completely smothered by the ashes of the burned bugs. The hotel offices are infested with such swarms that it was necessary to close the doors, notwithstanding the intense heat. In several instances church services were interfered with. The river bridges are almost impassable to pedestrians. The atmosphere about the lights is filled with clouds of live insects and floors are covered to a depth of several inches by dead ones."

PARRY SOUND, ONT.—The Town Council of Parry Sound, Ont., may dispose of the corporation's newly acquired power plant to a new company, called the Seguin Power Company, of Parry Sound, with a capital of $40,000. The new company proposes to supply power to industrial works which it will also assist in promoting.

WILLIAMSPORT, PA.—The Eagle's Mere Electric Light Company will furnish electric light to the Muncy Valley towns. The power house, situated two miles up the mountain from the town of Muncy Valley, is now supplied with power from Hunter's Lake.

PHILADELPHIA, PA.—It is authoritatively stated that the basis of the effort to acquire the Kensington Electric Company for the Philadelphia Electric Company has been by purchase of stock in the open market and through private sources. It is admitted in official quarters that the Philadelphia Electric people are now owners of most of the Kensington minority stock.

GREENSBURG, PA.—The Westmoreland, Alleghany & Westmoreland Electric Heat & Power Company, composed of Fort Wayne (Ind.) and Pittsburg capitalists, is making a stubborn fight at Greensburg, Pa., for franchises. It has been turned down by the local councils, but will try again. The Westmoreland Street Railway Company promises, if the new company is not given a franchise, to build a plant of its own.

GREENVILLE, PA.—The Greenville gas and water companies have been optioned to the syndicate which is building the electric railway from Sharon, Pa., to Youngstown, Ohio, and now own the electric lighting, power and gas plants of Sharon, Sharpsville and Youngstown, with franchises for several other towns in that district. The Greenville Electric Light Company also hold a franchise for steam heating and have a large exhaust steam heating business. H. W. Whipple, of New York City, is active in the consolidation.

PROVIDENCE, R. I.—A large portion of the real estate of the Phenix Iron Foundry at Providence, R. I., has been sold by the receiver, Harold J. Gross, to the Narragansett Electric Lighting Company. The property sold includes only the land and shell of the building on it.

ATHENS, TENN.—The East Tennessee Light & Power Company, of Athens, is in the hands of a receiver.

BRISTOL, TENN.—The Bristol Light & Power Company has installed $45,000 worth of additional machinery in its plant.

NASHVILLE, TENN.—Fire in the power plant of the Cumberland Electric Light & Power Company damaged belting, etc., to the extent of perhaps several thousand dollars.

WAVERLY, TENN.—The Waverly Electric Light Company, of Humphreys County, capitalized at $5,000, has been incorporated by Arthur E. Justice, B. R. Thomas, J. P. Cowden, J. F. Fowlkes, W. N. McCreary, H. H. Harris and N. C. Harris.

GEORGETOWN, TEX.—The town will hold an election to vote on the municipal electric light plant question.

BELTON, TEXAS.—The Belton Light & Power Company has been incorporated, with J. T. Smither, president; W. A. Stewart, vice-president, and F. E. Merrill, secretary-manager.

TEMPLE, TEX.—The Belton Light & Power Company, of Temple, capital stock $30,000, has been incorporated by F. E. Merrill, W. A. Stewart, of Bell County, and J. F. Swither of New York.

RICHMOND, VA.—The Tower-Binford Electric & Manufacturing Company has been awarded the contract for a complete power transmission plant for the Blackwell's Durham Tobacco Company at Durham, N. C.; also the contract for a lighting plant for Hollins Institute, at Hollins, Va.

FARMVILLE, VA.—The Virginia Normal State School of this city is to have an electric light plant, which will be completed and ready for use by the opening of the school in September. The contract for the plant has been awarded to the Electric Construction Company of Richmond, Va.

CHARLESTON, W. VA.—The water works, electric light and artificial gas plants of this city have been sold to a party of Wheeling capitalists, who were represented by Charles W. Swisher, of Fairmont, and John A. Howard, of Wheeling. The price paid was $300,000. The new company is also said to have an option on the street car system of this city.

APPLETON, WIS.—A $3,000,000 mortgage has been issued on the property of the Wisconsin Light, Heat & Traction Company in favor of the Milwaukee Trust Company.

TACOMA, WASH.—Within a few months the residents of Cape Nome will have a modern electric light plant installed in their city. Capt. F. N. Selberg has purchased the equipment, which cost $25,000. Coal to operate the plant will cost $18 a ton. The plant will have a capacity of 2500 incandescent lights of sixteen candle-power. It is proposed to charge 20 cents per day per light.

THE ELECTRIC RAILWAY.

BIRMINGHAM, ALA.—It is said that the Birmingham Railway Light & Power Company is making arrangements to institute a car line from Bessemer to East Lake, twenty miles in length. Tracks already extend between these points. Part of the line will be operated by electric power. One million dollars of the $6,000,000 bond issue recently decided upon will, it is said, be used for this purpose; 130 new cars, steel rails, etc., have been ordered.

SAN FRANCISCO, CALIF.—The Town Trustees of Berkeley, Calif., propose to declare void the franchise of the old horse-car line between East and West Berkeley. The road was purchased by the Oakland Transit Company, which recently removed the rails. As the franchise called for the continuous running of cars, it is claimed that the same can be declared forfeited. It is proposed in the event of a new franchise being granted, to stipulate that the town shall secure a percentage of the earnings of the line.

INDIANAPOLIS, IND.—The Valparaiso, Michigan City & Chicago Electric Railway Company has been incorporated. The capital stock is placed at $25,000, with privilege to increase.

FORT WAYNE, IND.—The Commissioners have granted to the Indiana & Ohio Traction Company the right to highways in Allen County for a line from Hicksville to Huntington, through this city.

INDIANAPOLIS, IND.—A contract has been signed by an Eastern construction company to build the Indianapolis, Morrestown & Rushville Interurban road. The estimated cost is from $1,000,000 to $1,500,000.

INDIANAPOLIS, IND.—The Indianapolis Street Railway Company has issued $300,000 of Citizens' Railway consols, to retire an equal issue of Citizens' first mortgage bonds. The new issue bears 5 per cent., against 6 for the old.

INDIANAPOLIS, IND.—The Eastern Indiana Traction Company has been incorporated, with a capital of $10,000. Peter Schwab, of Hamilton, Ohio, is president; Henry P. Lane, of Franklin, Ohio, vice-president, and Elias Falk, of Franklin, Ohio, is secretary and treasurer.

REITERSTOWN, MD.—The organization has been completed of a company which purposes building a trolley line from Reiterstown, Md., through Westminster to the Pennsylvania State line, and thence to Gettysburg, Chambersburg, Shippensburg and other Pennsylvania towns to Harrisburg. It is to be called the Baltimore, Westminster & Gettysburg Railroad Company. L. A. Sweigard is president. Engineers have been put to work locating the line in Maryland. Under the charter, which is from Maryland, the company is empowered to carry freight and passengers, and operate telephone and telegraph lines.

WESTBORO, MASS.—A charter is to be issued to the Westboro & Hopkinton Street Railway, to be in operation by Sept. 1. This line forms a link in the present chain of electric roads between Boston and Worcester, and considerably shortens the distance. A continuous line under single ownership is also thus established for about 27 miles, between Needham and Westboro. The route thus formed, while more direct than existing lines, is still somewhat longer than that planned by the Boston & Worcester Street Railway Company, which has now secured franchises over two-thirds of its total run and hopes to be running in a year or so.

LYNN, MASS.—The Lynn & Boston Street Railroad Company has ceased to exist. The system becomes the Boston & Northern Street Railway Company. The change is the result of the consolidation of the Lynn & Boston, Lowell, Lawrence & Haverhill, Nashua Street Railroad, Rockport Street Railway, Gloucester Street Railway, Gloucester & Essex Railroad, and the North Woburn, Wakefield, Stoneham, Reading and Lowell Street Railways. The entire system included 400 miles of road. The officers of the new corporation are Patrick F. Sullivan, of Lowell, president; E. C. Foster, of Lynn, vice-president and general manager, and H. C. Page, of Salem, general superintendent.

ST. PAUL, MINN.—Mr. Samuel Hill has announced that he will at once parallel the Twin City Rapid Transit system and establish a 5-cent fare between St. Paul and Minneapolis.

ASHEVILLE, N. C.—Work has been started on the Asheville and Weaverville electric road. A. F. Hart & Company are the contractors.

JERSEY CITY, N. J.—The North Hudson County Street Railway Company and the Paterson Street Railway Company have been merged into the Jersey City, Hoboken & Paterson Street Railway Company.

TRENTON, N. J.—The Lackawanna & Wyoming Valley Rapid Transit Company, which was incorporated about a year ago, has filed papers increasing its capital stock from $5,000,000 to $6,500,000. The company was incorporated to construct and operate railroads.

SCHENECTADY, N. Y.—A trolley line to Mount Pleasant and Athens Junction is to be constructed by the Schenectady Railway Company.

ITHACA, N. Y.—The Canastota & Gloversville Railway Company has been granted a franchise through the village of Canastota and the towns of Lenox, Lincoln, Fenner and Smithfield.

ROCHESTER, N. Y.—The New York State Railroad Commissioners, after a hearing, announced that they had decided to grant a certificate to the Ridge Trolley road from Rochester to Buffalo.

AMSTERDAM, N. Y.—The Amsterdam Street Railroad Company has decided to increase its capital stock from $250,000 to $1,000,000, the increase being necessary on account of the extension of the road.

ONEIDA, N. Y.—The Oneida Street Railway Company has ceased work on its proposed line to Utica. It is rumored that the Central-Hudson has bought out the company and will hold the franchise as a bar to possible competition.

HUDSON, N. Y.—The Albany & Hudson Railway & Power Company is making an endeavor to compromise the claims for damages arising from the collision on its road in May last, due to gross carelessness of employees. The claims already in amount to $330,000, and they are but one-third of the whole number.

FREEPORT, L. I.—The Mineola, Hempstead & Freeport Traction Company has received its franchise from the village trustees for building a trolley road from the northern limits at Seaman Avenue. The work of construction will be commenced next month. Franchises to build through Hempstead to Mineola have also been obtained by the company.

LITTLE FALLS, N. Y.—The Mohawk Valley Traction Company has filed articles of incorporation as an electric surface road. Its termini are to be the city of Little Falls and the village of Herkimer, a distance of eight miles. The capital stock is $8,000. The directors are residents of Central New York, excepting James D. Smith, of New York City, who subscribes for 764 of the 800 shares.

ONEIDA, N. Y.—The Oneida Street Railway has been bought by the Cleveland, Ohio, syndicate, which has recently bought all of the trolley lines in that vicinity. The syndicate was represented by Horace E. Andrews, of Cleveland, Ohio. The purchase price was not made public. The same syndicate has bought all the street railways in Utica and is extending double tracks east to Little Falls. A line will be built from Oneida City to Utica.

ROCHESTER, N. Y.—The Monroe County Electric Railway has incorporated with $250,000 capital. The directors of the company are Percy R. McPhail, Ira M. Luddington, George W. Aldridge, Merton E. Lewis, of Rochester; Andrew H. Bown, of Portfield; Walter A. Parce and D. C. Becker, of Fairport; W. H. Rowerdink, of Brighton, and Fred. W. Guernsey, of Pittsfield. The line will connect with the Rochester Railway Company.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has purchased the property necessary for the construction of the incline from Jamaica Avenue to the terminus of the Brooklyn "L" at Crescent Street, East New York. The connecting branch will start from a point on the "L" at Aetna and Crescent Streets, and winding around in a sort of double curve down to the level of the trolley line on Jamaica Avenue. There is no charter for the use of steam on Jamaica Avenue, and that method of propulsion, according to President Greatsinger, will have to be abandoned when the cars are run through to Jamaica.

NEW YORK CITY.—About 1200 men and women journeyed from Fordham, Morrisania, and other outlying districts in the Borough of the Bronx, last week to the City Hall to appear before the Joint Committee on Railways of the Council and the Board of Aldermen. The object of their journey was to convince the committee that the taxpayers of the upper district wanted a certain privilege granted to the Union Railway, which will be for the benefit of that entire section of the city. The measure advocated was the granting of a franchise to the railway company to extend its tracks across the Macomb's Dam Bridge, along the 155th Street viaduct, to the stations of the west side elevated railroad and to the Putnam Branch of the New York Central & Hudson River Railroad. At present those residents of that section who are compelled to take the Union Railway lines at Central Bridge for Tremont, Woodlawn, and other points are obliged to walk over a third of a mile from the terminals of the elevated and Metropolitan surface lines to the other end of Central Bridge, where they board cars upon transfers. The privilege asked, if granted, will do away with this walk.

FRANKLIN, OHIO.—The Cincinnati & Cleveland Railway Company has asked for a franchise through this place.

WAUSEON, OHIO.—The Toledo & Indiana Electric Railway Company has been granted a franchise through this place.

COLUMBUS, OHIO.—The Columbus Railway Company has declared the regular quarterly dividend of 1¼ per cent. on preferred stock, payable Aug. 1.

LONDON, OHIO.—The County Commissioners of Madison County have granted a franchise to the Findlay & Southern Railway for its line in this county.

YOUNGSTOWN, OHIO.—At a meeting of the directors of the Youngstown Park & Falls Electric Railway Company a semi-annnal dividend of 2½ per cent. was declared.

UPPER SANDUSKY, OHIO.—The officials of the Findlay & Marion Railway Company are planning to secure a right of way for a spur line to extend from Upper Sandusky to Tiffin.

BRYAN, OHIO.—The County Commissioners of Fulton County have granted a franchise through the county to the Toledo & Bryan Air Line Railway, which is promoted by J. L. Yost, of Toledo.

LIMA, OHIO.—The Allen County Commissioners have granted a franchise to the Lima, Lewiston & Bellefontaine Railway Company, which proposes to build from Lima to Lewiston and Bellefontaine.

CLEVELAND, OHIO.—The Cleveland & South Lorain Traction Company has been incorporated, with a capital of $500,000, by James H. Burke, Charles H. Wells, H. A. Beckerman and Frank W. Nowak.

CLEVELAND, OHIO.—The Everett-Moore syndicate has acquired control, at a price said to be above par, of the Little Consolidated Street Railway, the local system, in which Senator Hanna is largely interested.

CLEVELAND, OHIO.—It is stated that the Western Ohio Railway Company will shorten its main line from Cincinnati to Toledo by building a direct line from Wapakoneta to Sidney, as well as the line by way of St. Marys, New Bremen and Minister.

FINDLAY, OHIO.—The Findlay & Southern Railway Company, which is promoted by J. Rosenstock, of Cleveland, has applied for a franchise to enter the center of the city, right of way for the entire route from Columbus to Findlay having been secured.

CLEVELAND, OHIO.—It is reported that the movement of Thomas Childs for a franchise between Cleveland and Akron, is part of a project for the electric line between here and Cincinnati. It is claimed Mr. Childs is working in the interests of the men who are backing the road which is being built between Akron and Canton, and that it will be simply a link in the great chain across Ohio.

FREMONT, OHIO.—The Kerlin Brothers Company, promoters of the Tiffin & Port Clinton Railway, have closed a deal for the purchase of the right of way held by the Lakeside, Napoleon-Western Railway Company, the line owned by the Fremont Street Railway Company, and the power-house and short line owned by the Creager Electric Light Company. The consideration for the properties is said to have been $35,000.

COLUMBUS, OHIO.—The old Grove City & Green Lawn line has been formally transferred to the Columbus, Grove City & Southwestern Railway, which is a part of the Appleyard-Fisher system of roads. New officers for the company have been elected as follows: Emmett T. Thompkins, president; H. A. Fisher, vice-president; John G. Webb, treasurer, and S. M. Merrick, secretary.

CLEVELAND, OHIO.—M. J. Mandelbaum & Company has closed the deal announced some weeks ago, for the purchase of the property of the Hamilton & Lindenwald Electric Transit Company, consisting of nine miles of lines in Hamilton and connecting with Lindenwald. This gives the Southern Ohio Traction Company its own line through Hamilton. The company has been reorganized by the election of new officers as follows: W. C. Shepard, president; H. C. Lang, secretary and treasurer, and F. J. J. Sloat, general manager. The above, with A. E. Feith, of Cleveland, constitutes the Board of Directores. The new owners will spend $50,000 in improvements at once. The present power house will be abandoned and the road will be operated in connection with the Southern Ohio Traction Company. It is stated that the amount paid for the property was $225,000.

PROVIDENCE, R. I.—The Milford, Attleboro & Woonsocket electric road is said to be seeking a franchise for an extension from Plainville to North Attleboro.

NASHVILLE, TENN.—The Woodbury & Nashville Railway Company has applied for a charter of incorporation. The capital stock is placed at $300,000, and J. T. Crass, of this city, is at the head of the new concern.

SALT LAKE CITY, UTAH.—The local street railways are arranging a combination with $3,000,000 capital.

TACOMA, WASH.—The Tacoma-Seattle electric railway line is now under contract, the construction work having been let to Hale & Smith, of Portland, Ore. The road will be over 40 miles in length.

NEW INDUSTRIAL COMPANIES.

THE BENNETT-BERNHARDT ELECTRIC MANUFACTURING COMPANY has been formed for the purpose of manufacturing electrical appliances. Their address is Columbia, Pa.

STAR ELECTRIC GAS LIGHTER COMPANY of New York City, has been formed; capital, $25,000. Directors: Jacob Harzfeld, Julius Wielar, and Siegfried Scherk, New York City.

WASHINGTON, MO.—The Libbe Electric Company, of Washington, Mo., has been incorporated with a capital stock of $40,000. The incorporators are Anton A. Libbe, Henry D. Hibbeler and Hugh J. Minhinnick.

THE STANDARD ELECTRIC COMPANY, of Danville, Va., incorporated April 1, will open a branch house at Charlotte, N. C. Jas. G. Penn is president, and W. Drummond Marrow, general manager. The principal business will be engineering and construction.

THE CONSOLIDATED ELECTRIC CONSTRUCTION COMPANY has been incorporated in Cleveland, with $25,000 capital stock, by C. C. Bateson, F. C. Werk, Abraham Oppenheimer, A. A. Bemis and P. A. Zizelman. The company will deal in electrical material and supplies.

THE HERR CONSTRUCTION COMPANY has been incorporated in Cleveland, Ohio, by H. H. Herr, H. S. Herr, Frank Seither, F. H. Turner and G. H. Cowdrey; capital stock, $5,000. The company will furnish material for the construction of telephone, telegraph, electric railway and electric lighting systems.

THE AMERICAN INCANDESCENT LAMP COMPANY, of York, Pa., has been incorporated with a capital of $25,000. The directors are C. C. Frick, D. F. Lapean, R. S. Cannon, R. E. Manley, E. K. McConkey, Lemon Love and

W. O. Thompson are the directors. Mr. Paul Junkin, formerly superintendent of the Sawyer-Man Company's works, will be superintendent for the new company.

LEGAL.

WIRELESS TELEGRAPHY SUIT.—A Honolulu despatch states that the Marconi's Wireless Telegraph Company, Limited, has brought suit against Frederick J. Cross, manager of the Inter-Island Telegraph Company, in the First Circuit Court, for $5,500 and £500 sterling, which the company claims is due it as the second payment of $11,000 for installing the system of wireless telegraph now in operation between the various islands of the group from Oahu to Hawaii. The company, by its attorneys, Kinney, Ballou & McClanahan, states that on October 31, 1899, the plaintiff and defendant entered into a written agreement. The name of their corporation was then the Wireless Telegraph & Signal Company, Limited, which was changed later to Marconi's Wireless Telegraph Company.

TROLLEY FARES.—The principle involved in a decision handed down by the Supreme Court of Errors last week in the case of the Fair Haven & Westville Railroad Company against the city of New Haven has attracted the interest of municipalities and trolley corporations. The municipal authorities of New Haven granted the petition of the company to lay a double track to East Haven, with the proviso that only a five-cent fare should be charged between New Haven and Morris Cove. The company, resenting the condition, appealed to the courts. The finding of the Supreme Court sustains the contention of the railroad corporation, and decrees that the condition is void because the municipality had no authority to impose it. The decision is important as defining and limiting the conditions which a Connecticut city may impose on a street railway company.

TRIAL POSTPONED BY TELEPHONE.—Note has been made in these columns to the effect that two men accused of creating a disturbance on a Maine railway train had had their case tried over a telephone. The Justice who had jurisdiction in the matter lived at a considerable distance from the town where the defendants had been arrested, and as they were anxious to continue their journey on the train, they were allowed to plead guilty over the telephone, the Justice in his turn imposing a fine. In an action brought by Henry B. Hardenburgh and Charles J. Tiensch against Frank Fish in a Justice's court, this State, the Justice allowed an adjournment of the case because the attorney for the plaintiff informed him by telephone a few minutes before the expiration of the hour that he was detained, but would soon arrive. Justice Edwards, for the Third Appellate Division, on appeal, says: "A Justice has a reasonable discretion to exercise after the expiration of the hour to which the cause is adjourned, and where he has knowledge or information that the party intends to appear and will soon arrive, he does not lose jurisdiction by granting a reasonable indulgence. In this case the plaintiff's attorney, whose office was in the same village with that of the Justice, informed the Justice personally by telephone a few minutes before 10 o'clock that he was detained, but would shortly arrive, and requested that Mr. Northrup appear for him, and that the case be held open. This was communicated to the defendant, who left the office of the Justice before the hour of 10 arrived, preferring perhaps the chance of success on an appeal, through some technicality, to a trial of the merits before the Justice. The indulgence of between five and ten minutes granted by the Justice was not unreasonable, and no advantage was taken of the defendant."

PERSONAL.

GENERAL THOMAS T. ECKERT, president of the Western Union Telegraph Company, has been elected a director of the Union Pacific road.

MR. HENRY C. PAYNE, the well-known electric railway and telephone manager of Milwaukee and vice-chairman of the Republican National Committee, is seriously ill with gout at the Frankfort Hotel in Berlin.

MR. WILLARD E. CASE, the well known experimenter and electro-chemist, has, we regret to note, just lost his brother, Mr. Howard E. Case, who died suddenly while on a coaching tour through England. The Cases are one of the wealthiest families in Northern New York.

HON. C. A. SCHIEREN, the distinguished merchant and ex-Mayor of Brooklyn, N. Y., has just returned from a long trip abroad, during which he represented the New York Chamber of Commerce at the reception given that body in England. He has just started in Hamburg a branch of his leather business which will serve as a center for the concern's large European trade.

MR. GARDINER G. SIMS is now back in the old harness of engine building, and his host of friends will be glad to learn that the shops of the Harris Engine Company, at Providence, R. I., are running 23½ hours daily. Mr. Sims is building both the Harris-Corliss and the improved Armington-Sims types.

Mr. R. A. BYRNS, General Sales Agent of the United Telpherage Company for Mexico and the West Indies, has recently returned from a short business trip to Cuba. The numerous and interesting inquiries as to this overhead system of light freight transportation promise a large business in the tropics.

MR. JOHN H. HARE, of Baltimore, has, it is said, invented an improvement in the making and handling of records for phonograph and graphophone. It will no longer be necessary to wrap up records in cotton, and they may be made to run for an hour if desired, so that whole lectures or concerts can be taken.

MR. F. BATHURST, of the Conduit & Insulation Company, Limited, London, who has been in this country for some weeks with his wife, on business, and has visited various cities, sailed for home by the "Teutonic" on Wednesday, well satisfied with the results of his trip. Mr. Bathurst is a keen and intelligent observer and is well known in electrical circles in this country.

MR. F. G. SYKES, formerly electrical engineer of the Brooklyn Edison Company, resigned his position with that company on June 1 to accept a position with the General Electric Company. He sails from San Francisco on August 10 for Sydney, N. S. W., Australia, where he will have charge of the installation of the machinery for the New South Wales Government tramway system.

MR. ALFRED SKITT, Vice-President of the Manhattan Railway Company, was asked by a friend with whom he was chatting when he expected to go on his vacation. "Vacation?" exclaimed the busy executive officer of the elevated system, "well, I may get a good long one three years from now, when the electric motive power is fully installed for Manhattan, but not until then. I have not had a vacation for fifteen years, but have lived it out at Yonkers, and, after all, I have not had such a very hard time of it." Mr. Skitt has the proverbial English staying power.

EDUCATIONAL.

STEVENS INSTITUTE.—The annual catalogue (for 1901-1902) of the Stevens Institute of Technology, Hoboken, N. J., has just been issued. Besides the curriculum, it contains much interesting information regarding this well-known institution, from which many eminent electrical engineers have been graduated.

UNIVERSITY OF MISSOURI.—The 1900-1901 Bulletin of the University of the State of Missouri, at Columbia, contains 268 pages of interesting information about this university. It gives outlines of the studies in the various courses, and at the back are lists of the students variously classified. The annual report of the Board of Curators to the Governor of Missouri shows that 1481 students were, at the time the report was made, enrolled in the whole university, fifty-two States, Territories and foreign countries being represented. The university gives a course in civil, electrical and mechanical engineering.

Trade Notes.

THE ELECTRIC APPLIANCE COMPANY, Chicago, have just issued descriptive matter pertaining to their new series and bridging cabinet type telephones. Circular will be mailed upon application.

A. L. IDE & SONS, Springfield, Ill., have issued a new little booklet descriptive and illustrative of their various types of Ideal engines at present being manufactured by them. There is little text, but the cuts are abundant and good.

INDUCTOR ALTERNATORS.—The Electric Machinery Company, Minneapolis, Minn., in its Bulletin No. 28 describes an inductor alternator of its manufacture. The bulletin is well printed on half-tone paper and every detail of the alternator is illustrated by excellent engravings.

STOW FLEXIBLE DRILL.—A new edition of the catalogue of the Stow Manufacturing Company, Binghamton, N. Y., contains 72 pages, in which are illustrated the application of the flexible drill to a surprising variety of uses. Some pages of the catalogue are devoted to the Stow multispeed motor, of which several types are shown.

MR. D. M. STEWARD, Chattanooga, Tenn., has purchased the entire plant and effects of the D. M. Steward Manufacturing Company, and the business will be continued by him under the same name. There will be no change in the management, as Mr. D. M. Steward has been for twenty-five years president and manager as well as majority stockholder in the old corporation.

"KILFYRE."—Mr. Denis J. Swenie, for so many years chief of the Chicago Fire Department, has just been made president of the Chicago Fire Appliance Company, which is the Chicago Agency for "Kilfyre." While Chief Swenie was head of the department, he had occasion to witness and prove the usefulness of "Kilfyre," and immediately upon his retirement took steps to identify himself actively with the "Kilfyre" interests.

M. B. ELECTRIC COMPANY, 203 Franklin Avenue, Cleveland, Ohio, have an exhibit in Electricity Building at the Pan-American Exposition, Buffalo, of a great variety of detail electrical apparatus. They make a specialty of small fan motors, medical appliances, lighting with batteries, and many other minor applications for which there is a large and growing demand. They invite inquiries and will be glad to send their catalogue and trade literature.

ENCLOSED FUSES.—The use of enclosed fuses is becoming so general and they afford such a superior protection to property and lessen fire risk to a minimum, that their strong endorsement by the National Board of Fire Underwriters is quite natural. The Central Electric Company, of Chicago, is agent for the D. & W. enclosed fuses, as well as other safety devices, and finds that the merits of the enclosed fuse are beginning to be fully appreciated.

STEAM SPECIALTIES.—The latest edition of the catalogue of James L. Robertson & Sons contains 64 pages, in which are illustrated and described the long line of steam specialties which this company has made so well known throughout the country. A number of pages is devoted to well written illustrated descriptions of the improved Robertson & Thompson indicator and of the improved Willis planimeter. One of the latest improvements to the latter is an adjustment whereby the horse power of cards may be read directly from a scale.

G. I. EXCURSION.—The officers and employees of the General Incandescent Arc Light Company participated in a pleasant and enjoyable outing at "Stimmels," Whitestone Landing, L. I., Saturday, July 27. A spirited and hotly contested game of baseball between the factory and office forces resulted in a tie, score 16 to 16. Bathing, bowling, wrestling and other sports occupied the time in ways that were more than pleasant, and after an enjoyable banquet, all voted the day a jolly one and to be long remembered. The outing was held under the auspices of the "G. I." Club.

LIGHTNING ARRESTERS.—Another artistic production of the General Electric press is a pamphlet on lightning arresters. The cover is remarkably effective and a number of the text pages have a decorative background that would attract attention in the best type of monthly magazines. The introduction to the pamphlet is an article on thunderstorms, written by Mr. Alfred F.

Simms, local forecast official at Albany, N. Y., which includes rules for forecasting such storms. The remainder of the pamphlet is divided into three sections, one of which is on the lightning arrester for direct-current circuits, another on the same for alternating-current circuits, and in the third and final section are given numerous diagrams of lightning arresters and their connections.

NOISELESS PINIONS FOR THE MINT.—The New Process Raw Hide Company, Syracuse, N. Y., has received a contract from the United States Mint at Philadelphia for 6 New Process Noiseless pinions 16 inch diameter, 6 inch face. These pinions are a part of the equipment of the new mint building, the machinery for which is just being installed. They are to be used for transmitting power from a 50-horse-power motor to a 10x9 inch rolling mill, and will run 175 r. p. m., meshing into a 60 inch iron gear. Six armature pinions for the same motors were shipped by the company a short time ago. They are 12⅝ inch diameter, 4 inch face, and will run at a speed of 525 r. p. m.

AN AUTOMOBILE STORY.—It is said that no more original or more entertaining bit of nonsense was ever written than George Hibbard's "A Vehicle of Love," to appear in *McClure's Magazine* for August, and Howard Chandler Christy has caught the true spirit of the summer romance in his beautiful pictures. Two lovers have quarrelled, have parted forever, and have started on their separate ways. Unfortunately, or fortunately, their ways lie side by side, and the lovers are soon forced into an automobile hansom, greatly against their will, by a gray-haired "idiot." The chauffeur loses control of the electric carriage, which runs away, "at a quiet, decent enough gait," for some time. There are no accidents of any consequence, but something very interesting happens.

FEED WATER HEATERS.—Special machinery for heating and purifying feed water for steam boilers, as manufactured by the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio, is fully described and illustrated in a pamphlet of 96 pages, just issued by that company. The nature of steam boiler incrustation, the evils arising therefrom and the best manner of remedying the same, are explained and described, special emphasis being laid, of course, upon the advantages of this company's apparatus. Then follows a description of the operation of Stilwell's improved lime-extracting heater and filter combined, and several well executed illustrations show the construction of the apparatus. Various full-page illustrations show actual installation of these heaters and purifiers, and at the back of the catalogue there are several pages containing fac simile reproductions of letters from various concerns in which many good things are said about this apparatus. Accompanying the catalogue is a circular on Stilwell's cast-iron heater. This material is used in the construction of this heater on account of its resistance to the action of acids, salts and other impurities contained in water.

CHARLES H. BESLY & COMPANY, 10 and 12 North Canal Street, Chicago, Ill., report their general business very good. They are receiving many orders for chucks, vises, power hack saws and general supplies from many concerns that are closing down for their annual repairs. They are still working overtime at their factory, Beloit, Wis., and have added many new machines to their equipment in their endeavor to increase their output. They report that they have never sold as many Gardner grinders and Besly band machines as at the present writing, recent shipments having been made to New York, Pennsylvania, New Jersey, Massachusetts and Rhode Island. They are calling special attention to their new spiral paper circles to be used on Gardner grinders. They are now able to produce abrasive circles suitable for work on steel, cast iron, drop forgings, malleable iron, aluminum and the alloyed metals, gutta percha and wood, and have thus increased the field for the grinders. Samples of these new circles for trial will be sent to users of their machine without charge, stating metal to be ground. Their new 300-page illustrated catalogue is now ready for distribution, and will be mailed free to any address upon application.

Record of Electrical Patents

PATENTS ISSUED JULY 16, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

678,508. UNDERGROUND CONDUIT; J. T. McRoy, Chicago, Ill. App. filed Dec. 19, 1900. The invention consists in constructing the conduit so that an obstruction in the line of the same may be passed without interrupting the continuity of the conduit.

678,757. APPARATUS FOR AUTOMATICALLY FIRING SHIPS GUNS; L. Obry, Trieste, Austria-Hungary. App. filed Dec. 7, 1900. Involves the use of a gyroscope-like device for determining the moment the line of sight of the ships gun is horizontal.

PATENTS ISSUED JULY 23, 1901.

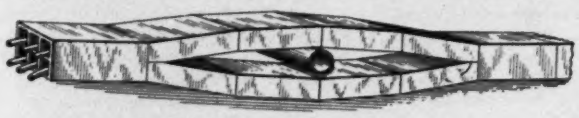
11,922. TELEPHONE CIRCUITS; P. G. Burgess, Mexico, Mexico, and H. W. Wilder, Albany, N. Y. App. filed Jan. 13, 1899. The invention comprehends a compound circuit arrangement wherein three telephones are so relatively placed and connected by appropriate circuit conductors that while the receiving instrument of one of them, which may be called A, shall be responsive to the transmission of both the others, B and C, and shall be able to reproduce the message transmitted by means of the said others, the receiver of B will not respond to, receive, or reproduce the transmission of C, and the receiver of C will in like manner be neutral or irresponsive to B.

678,851. APPARATUS FOR ELECTROLYSIS OF THE SALTS OF ALKALI METALS; Henry S. Anderson, of Springfield, Mass. App. filed Nov. 28, 1899. A mercury cathode contained in a vessel having a porous lining is kept in motion by being forced into and out of the vessel through vertically-arranged channels in the lining, which communicate with a vessel above the level of the mercury cathode.

678,853. MOTOR CONTROL SYSTEM; Albert H. Armstrong, Schenectady, N. Y. App. filed April 8, 1901. (See Current News and Notes.)

678,854. CONTROL OF INDUCTION MOTORS; Albert H. Armstrong, of Schenectady, N. Y. App. filed May 9, 1901. (See Current News and Notes.)

678,861. SYSTEM OF MOTOR CONTROL; F. E. Case, Schenectady, N. Y. App. filed Feb. 15, 1901. A system of control involving relays operated



678,508.—Underground Conduit.

by a small current taken from the trolley line for controlling the switches which operate the resistance cut-outs.

678,864. COIL RETAINING DEVICE; J. T. H. Dempster, Schenectady, N. Y. App. filed March 28, 1901. The armature slot is closed by a strip of wood reinforced with sheet metal.

678,873. ELECTRIC ARC LAMP; J. A. Heany, Philadelphia, Pa. App. filed Nov. 14, 1900. Details of a clutch mechanism.

678,874. ELECTRIC MOTOR; J. A. Heany, Philadelphia, Pa, App. filed Nov. 19, 1900. The field magnet has two windings oppositely arranged and a commutator is adapted to connect either or both windings with the main circuit.

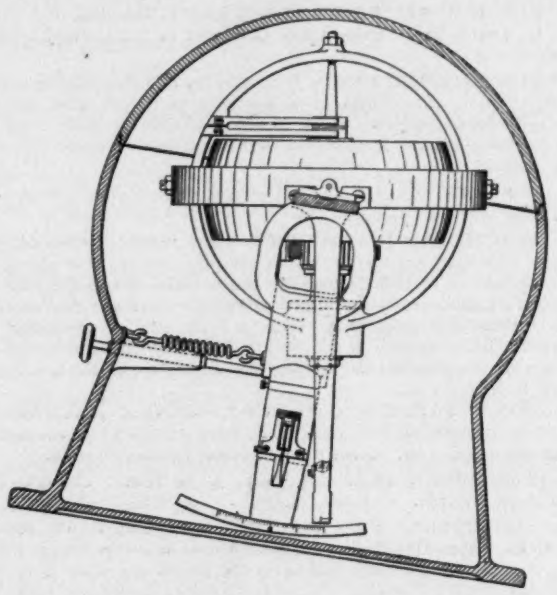
678,875. ELECTRIC MOTOR; J. A. Heany, Philadelphia, Pa. App. filed Nov. 19, 1900. The armature is provided with two oppositely arranged windings and a commutator is adapted to bring either or both windings into the main circuit to reverse or neutralize the two poles of the armature.

678,876. ELECTRIC ARC LAMP; J. A. Heany, Philadelphia, Pa. App. filed Jan. 28, 1901. Details of a clutch mechanism.

678,878. LOCATING GROUNDS ON ELECTRIC CIRCUITS; Edward M. Hewlett, of Schenectady, N. Y. App. filed March 14, 1900. (See Current News and Notes.)

678,880. CONDUIT PLOW; J. Hoffman, Schenectady, N. Y. App. filed March 12, 1900. A conduit plow provided with a shank composed of two metal plates stamped with offsets to form, when assembled, a housing for the conductors leading from the collector shoes.

678,881. CIRCUIT-BREAKER; Charles E. Holmes, of Lynn, Mass. App.



678,757.—Apparatus for Automatically Firing Ships' Guns.

filed March 31, 1900. A plug switch has a metal socket forming one circuit terminal, the other terminal consisting of a stem movable in the socket, and having a helical spring which acts to retract the stem into the socket. When the stem is pulled sufficiently to overcome its friction in the contact hole, the spring rapidly rebounds, and any arc at the terminals is thus extinguished.

678,887. RESISTANCE DEVICE; C. W. Larson, Schenectady, N. Y. App. filed Jan. 18, 1900. An electric resistance comprising a metallic body provided with cavities, resistance-conductors in said cavities, and plastic material adapted to secure said conductors within said cavities by mechanically interlocking with said body.

678,894. TROLLEY SIGNAL; C. H. Morse, Cambridge, Mass. App. filed Aug. 11, 1900. The signals are set by means of mechanical devices and circuits controlled by the trolley pole.

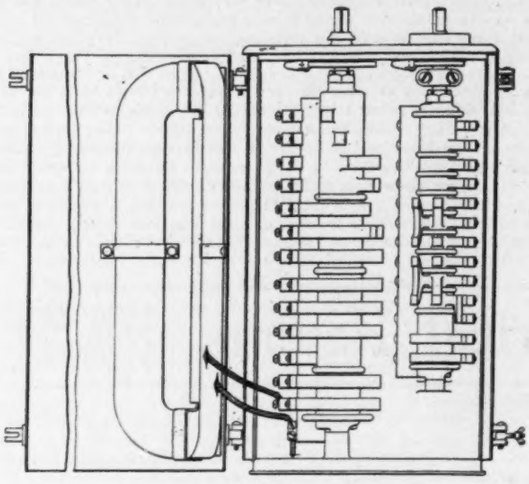
678,904. DYNAMO ELECTRIC MACHINE; Edwin W. Rice, Jr., of Schenectady, N. Y. App. filed April 25, 1900. (See Current News and Notes.)

678,905. CONTROLLING HIGH-POTENTIAL CIRCUITS; Edwin W. Rice, Jr., of Schenectady, N. Y. App. filed May 24, 1900. (See Current News and Notes.)

678,914. CONTROLLER FOR ELECTRIC MOTORS; E. W. Stull, Johnstown, Pa. App. filed Jan. 14, 1901. The blowout coil is attached to the door of the controller box so as to be moved out of the way when the box is opened to inspect or repair the controller.

678,916. ELECTRIC ARC LAMP; Elihu Thomson, of Swampscott, Mass. App. filed Dec. 26, 1899. (See Current News and Notes.)

678,920. LAMP SOCKET; J. C. Tournier, Schenectady, N. Y. App. filed March 9, 1899. The threaded plug of a T.-H. socket is made of sheet metal stamped into required form and screw-threaded.



678,914.—Controller for Electric Motors.

678,925. HIGH OR LOW WATER ALARM; C. E. Zimmerman, Syracuse, N. Y. App. filed Aug. 1, 1900. Electrical devices operating to sound an alarm in which the circuit can be opened by hand and in which the circuit will be a second time closed in case the cause of the alarm is not at once removed.

678,929. ELECTRIC METER; John Henry Barker and James Alfred Ewing, o. Cambridge, Eng. App. filed April 6, 1901. (See Current News and Notes.)

678,951. ELECTRIC ARC LAMP; J. A. Heany, Philadelphia, Pa. App. filed Dec. 13, 1900. The feeding device is located in the air-tight arc-inclosing globe.

678,952. ELECTRIC ARC LAMP; J. A. Heany, Philadelphia, Pa. App. filed April 30, 1901. The clutch is in the form of a split tube, the parts of which are hinged together so as to swing towards or away from the carbon at the same time it makes its vertical movement under the attraction of a solenoid.

678,953. ELECTRIC CLOCK; G. Hookham, Birmingham, England. App. filed Dec. 15, 1900. Details.

678,957. ELECTRICAL INSTRUMENT; John Forrest Kelly, of Pittsfield, Mass. App. filed April 23, 1901. A reducing condenser is placed in series on each side of a static instrument and between it and the high-potential main, the condensers being located so as to remove any danger of contact with the high-potential mains connected thereto. A condenser of comparatively large capacity is also placed in shunt to the instrument in order to obviate disturbances due to the capacity of the static instrument with which it is connected.

678,964. COMMUTATOR FOR DYNAMO ELECTRIC MACHINES; F. A. Merrick, Johnstown, Pa. App. filed Nov. 14, 1900. A support for the commutator segments, having a raised center bearing therefor.

678,972. TELEPHONE TRANSMITTER; J. G. Nolen, Chicago, Ill. App. filed April 11, 1901. Details.

678,989. CONTROLLER FOR ELECTRIC MOTORS; E. W. Stull, Johnstown, Pa. App. filed Sept. 28, 1900. Means whereby neither the controlling nor reversing handles can be moved unless the other is in its proper position.

678,990. CUT-OUT BLOCK; H. O. Swoboda, New York, N. Y. App. filed Jan. 22, 1900. The socket and plug are constructed so that the latter cannot be inserted in the former in any way except the correct way.

678,991. CIRCUIT BREAKER; H. P. Ball, New York, N. Y. App. filed July 7, 1900. Details.

678,998. SYSTEM OF ELECTRICAL DISTRIBUTION; Harry E. Heath, of Windsor, Canada. App. filed May 15, 1901. (See Current News and Notes.)

679,002. RAIL BOND; A. Markle, Hazleton, Pa. App. filed Jan. 19, 1901. A rail bond consisting of two conductors adapted to be fastened to abutting rails with their ends brought into parallel relation, plastic material electrically connecting said ends and an inclosing box containing the ends.

679,004. AUTOMATIC ELECTRIC STOP FOR ELEVATORS; H. B. Newhall, Jr., Plainfield, N. J. App. filed Oct. 31, 1900. Automatic controlling devices for an ammunition hoist, having ascending and descending platforms arranged on a cable and driven by an electric motor.

679,006. SYSTEM OF ELECTRICAL DISTRIBUTION; Edwin W. Rice, Jr., of Schenectady, N. Y. App. filed Dec. 12, 1899. (See Current News and Notes.)

679,008. SYSTEM OF ELECTRICAL DISTRIBUTION; Charles Proteus Steinmetz, of Schenectady, N. Y. App. filed Dec. 9, 1899. (See Current News and Notes.)

679,029. CALLING DEVICE FOR TELEPHONE EXCHANGES; F. A. Lundquist, Chicago, Ill. App. filed May 17, 1899. Located at each telephone are certain devices by the manipulation of which a series of electrical impulses are sent through successive magnets located at a central exchange, which magnets operate other devices for making the desired connection.

679,050. LIQUID FEED DEVICE FOR ELECTROLYTIC APPARATUS; Raoul Girouard, of Westbrook, Me. App. filed May 11, 1899. A device for feeding liquid to electrolytic apparatus, which guards against accidental leakage of electricity. A stream of mercury is fed in small intermittent quantities through a tube, which causes the mercury to be supplied intermittently in drops, thus automatically insulating the columns from the continuous body of liquid in the feed apparatus and supply reservoir.

679,057. JUNCTION BOX AND ADAPTER FOR ELECTRICAL INSTALLATION; J. Meehan, Brooklyn, N. Y. App. filed May 16, 1901. The adapter is intended to be a permanent attachment which can be inspected without trouble and when so attached to the junction box, will be a guarantee that the work is well done and a preventive against grounded wires and wrong connections in the junction box.

679,092. SYSTEM OF ELECTRICAL DISTRIBUTION; Charles Proteus Steinmetz, of Schenectady, N. Y. App. filed Jan. 2, 1901. (See Current News and Notes.)

679,102. SYSTEM OF ELECTRICAL DISTRIBUTION; Ernst J. Berg, of Schenectady, N. Y. App. filed Jan. 2, 1901. (See Current News and Notes.)

679,138. ELECTRIC METERING SYSTEM; Dr. Louis Bell, of Newton Center, Mass. App filed March 26, 1900. (See Current News and Notes.)

679,151. COMBINED SWITCH AND CIRCUIT-BREAKER; Thos J. Johnston, of Schenectady, N. Y. App. filed Feb. 16, 1899. The usual circuit-closing switch is combined with an auxiliary circuit-opening apparatus by which the circuits of the coils operating the switch are so modified upon excessive current flow, that the switch acts as its own circuit-breaker.

679,174. POWER FACTOR METER; Paul M. Lincoln, of Niagara Falls, N. Y. App. filed March 27, 1901. (See Current News and Notes.)

679,175. FREQUENCY OR SPEED INDICATING AND REGULATING DEVICE. Paul M. Lincoln, of Niagara Falls, N. Y. App. filed March 27, 1901. (See Current News and Notes.)

679,206.—Locking Lamp Socket.

678,876.—Arc Lamp.

679,197. ELECTRICALLY OPERATED GAS BURNER; H. W. Webb, Columbus, Ohio. App. filed April 27, 1901. Details.

679,206. LOCKING SOCKET FOR INCANDESCENT ELECTRIC LAMPS; C. R. Barrett and E. C. Phillips, Chicago, Ill. App. filed May 13, 1901. The lamp base is locked in the socket and can only be released by insertion of the key into an orifice provided in the socket.

789,220. TROLLEY; N. Durant, North Adams, Mass. App. filed Aug. 18, 1900. A frame carrying the wheel is pivoted to the trolley pole at a point in the rear of the wheel.

679,222. PARALLEL ADJUSTABLE SWING JOINT; E. J. Filiatrault, Duluth, Minn. App. filed March 18, 1901. A conduit joint comprising interlocking bifurcated members, means for locking said members at any desired angle with relation to each other, and means for operating said locking means.

679,239. CATOPHORIC PAD; J. F. Mossberg, Minneapolis, Minn. App. filed Dec. 10, 1900. Details.

679,253. PROCESS OF OBTAINING VOLATILE ELEMENTS FROM THEIR COMPOUNDS; Alfred H. Cowles, of Cleveland, Ohio. App. filed July 19, 1900. An electric current is passed through a compound of a volatile electro-positive element, whereby such element is deposited on a porous cathode, and maintained in a state of vapor and the vapor caused to pass through the cathode and be condensed. The bath is maintained at a temperature higher than that of the volatilizing element. The porous cathode is of carbon or other suitable material and forms the floor of an electric furnace; the volatilized element passes through this floor into a receptacle underneath where it is condensed.

679,284. ARMATURE WINDING; W. Lau, Berlin, Germany. App. filed March 19, 1900. To avoid lengthening the armature, those portions of the coils crossing the end of the armature are provided with less insulation than the portions lying in the groove.